NUCLEAR SCIENCE ABSTRACTS

Volume 32 Number 9

Abstracts 21812-24121

November 15, 1975

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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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Volume 32, Number 9, November 15, 1975

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the ERDA Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts*.

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Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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For the two 12-issue volumes, the annual subscription rate is $121.05 for domestic subscribers and $151.35 for foreign subscribers. A single issue costs $5.05 domestic rates or $6.26 foreign rates. Domestic rates apply to the United States, Canada, Mexico, and Central and South American countries except Argentina, Brazil, Guyana, French Guiana, Surinam, and British Honduras.

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Vol. 29, Subjects and Authors (Jan.–June 1974), $20.10.
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Cumulative Report Number Index, Vols. 1–15 Revised, $4.00.
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Cumulative Report Number Index, Vols. 21–28, $9.35.

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INDEXES TO *NSA*

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

```
HOLLOWAY, J.A., Survey of image
    processing methods for
    radiography, 31:16491
HOLLWEG, J.V., Hydromagnetic waves in
    interplanetary space, 31:17953
HOLMBERG, E.B., Distribution of
    clusters of galaxies as related to
    galactic absorption, 31:18040
HOLMES, J.J., See BATES, J.F., 31:17444
```

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

```
NUCLEAR POWER PLANTS/REACTOR LICENSING
  Experience acquired in the design and construction of
    operating plants (German Federal Republic), 31:19104
NUCLEAR POWER PLANTS/REACTOR SAFETY
  Conception of radiation safety in atomic electric power
    plants, 31:15032 (CONF-701074-P1)
NUCLEAR POWER PLANTS/SITE SELECTION
  Safety-related site parameters for nuclear power plants,
    31:19052 (WASH-1361)
  Status and development of nuclear power in the Federal
    Republic of Germany, 31:19105
NUCLEAR PROPERTIES/RESEARCH PROGRAMS
  Accelerator physics group progress report, July--December
    1973 (Research summaries), 31:18544 (INS-R-139)
```

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

17606 (ANL/HEP-7440, pp L1-L12) ACCELERATED POLARIZED PROTONS AT THE ZGS. Ratner, L. G. (Argonne National Lab., IL). Feb 1974.
From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (6 Feb 1974).
In symposium on high-energy physics with polarized beams.

is indexed as:

```
ARGONNE NATIONAL LAB., ILL. (USA)
  Accelerated polarized protons at the ZGS, 31:17606
    (ANL/HEP-7440)
  Acceleration of polarized protons in synchrotrons,
    31:17692 (ANL/HEP-7440)
  Analysis of population, birth, and death statistics in
    the counties surrounding the Big Rock Point Nuclear
    Power Station, Charlevoix County, Michigan, 31:16552
    (ANL-8149)
  Argonne polarized target facilities, 31:17762 (ANL/HEP-
    7440)
  Calculation of transient fission-gas release from oxide
    fuels, 31:19031 (ANL-8143)
```

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

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WASH-
  1164          31:19025  Dep. NTIS, $16.00
  1359          31:16524  Dep. NTIS, $10.00
  1361          31:19052  Dep. NTIS, $3.75

WCAP-          (Misc.)
  7906          31:19053  Dep. NTIS, $5.50

XDC-
  60-3-60       31:18403  Dep. NTIS, $7.25

XN-            (Non-ERDA)
  74-21(Rev.1)  31:19054
  209(Suppl.4)  31:16750  Exxon, Richland, WA
  (Rev.1)

Y-
  1966          31:19188  Dep. NTIS, $4.00
```

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

Refer also to abstracts 22012 and 22013.

21812 (NP-20507) ANNUAL REPORT, 1974. Weber, M. (comp.). (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie). Jun 1975. 167p. (In German). Dep. NTIS (US Sales Only) $11.50.

Research is reported on the operation of the TRIGA reactor, rapid chemical separation, detection of short-lived nuclei, nuclear spectroscopy, nuclear fission, superheavy elements and heavy-ion reactions, mass separation, and activation analysis. Individual papers were title-listed. (JSR)

For titles of individual papers see: 21824, 21897–21905, 22057, 22058, 23416, 23417, 23435–23442, 23458, 23491–23493, and 23677.

21813 (ZFK-280, pp 58-84) NUCLEAR ANALYTICAL CHEMISTRY. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, Ger.). Jul 1974. (In German).

In annual report, 1974. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

In addition to brief abstracts of research already reported in the literature, research is reported on the determination of C by deuteron activation, determination of N in Si by proton activation, optimization of the measurement regime of decay curves for non-destructive analyses, x-γ coincidence spectrometry for the measurement of low activities, simultaneous storage of spectra and supplementary signals with a multichannel spectrometer, selective separation of ^{24}Na and ^{42}K from biological material by sorption on inorganic exchangers, determination of Hg in biological materials by neutron activation, activation analysis of Pt in rare metals, determination of low quantities of ^{131}I in ^{99}Mo, methods and detection limits for U, fission products, ^{14}C, ^{35}S, ^{32}P, and ^{3}H in excretion analyses, determination of solvent retention in alkyd resin varnish using ^{14}C-labelled solvents, gas radiochromatography of ^{14}C-labelled organic compounds, sensitivity of a solid-state track detector with a CN base, methods of high-resolution alpha spectrometry using solid-state track detectors, and estimation of the registration threshold for α particles. (JSR)

21814 TRACE ELEMENTS IN FUEL. Babu, S. P. (ed.). Advances in Chemistry Series 141. Washington, DC; American Chemical Society (1975). 223p. $15.50.

Fifteen papers are included. Topics covered include: mineral matter and trace elements in coal; trace impurities in coal by wet chemical methods; trace elements in coal by optical emission spectroscopy; trace elements in coal dust by spark-source mass spectrometry; major and miner constituents in silicons materials by atomic absorption spectroscopy; x-ray fluorescence analysis of whole coal; trace impurities in fuels by isotope dilution mass spectrometry; trace elements in coal by neutron activation analysis with radiochemical separations; trace elements by instrumental neutron activation analysis for pollution monitoring; major, minor, and trace element composition of coal and fly ash, as determined by instrumental neutron activation analysis; the fate of some trace elements during coal pretreatment and combustion; total mercury mass balance at a coal-fired power plant; trace element mass balance around a coal-fired steam plant; major, minor, and trace elements in the liquid product and solid residue from catalytic hydrogenation of coals; and environmental toxicology aspects of trace element emissions. (MCG)

For abstracts of individual papers see: 21836–21839, 21863–21866, and 21889.

Activation and Nuclear Reaction Procedures

Refer also to abstracts 22262, 22320, 22405, 22672, and 23067–23069.

21815 (CONF-741001-, pp 557) MICROCOMPUTER-BASED SYSTEMS FOR AUTOMATIC CONTROL OF SAMPLE IRRADIATION AND CHEMICAL ANALYSIS OF SHORT-LIVED ISOTOPES. Bourret, S. C. (Univ. of California, Livermore). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Two systems resulted from the need for the study of the nuclear decay of short-lived radionuclides. Automation was required for better repeatability, speed of chemical separation after irradiation and for protection from the high radiation fields of the samples. A MCS-8 computer was used as the nucleus of the automatic sample irradiation system because the control system required an extensive multiple-sequential circuit. This approach reduced the sequential problem to a computer program. The automatic chemistry control system is a mixture of a fixed and a computer-based programmable control system. The fixed control receives the irradiated liquid sample from the reactor, extracts the liquid and disposes of the used sample container. The programmable control executes the chemistry program that the user has entered through the teletype. (auth)

21816 (FFIF-F-606) INVESTIGATION OF THE IODINE CONTENT IN THE THYROID GLANDS OF CATTLE FROM THREE DISTRICTS IN NORWAY. Roald, S. (Forsvarets Forsknings-institutt, Kjeller (Norway)). Jan 1975. 20p. (In Norwegian). Dep. NTIS (US Sales Only) $4.00.

Weight, iodine concentration and total iodine content of thyroids in cows from three geographically heterogeneous areas (Stavanger, Oslo, Tynset) in Norway were investigated. The iodine measurements were done by instrumented neutron activation analysis. No differences in the thyroid weight were traceable between the three places, whereas the iodine concentration of the glands from the Oslo district was significantly lower than those from the other places. The same tendency applied for the total iodine content. (auth)

21817 (FFIF-F-607) INVESTIGATION OF THE IODINE CONTENT IN THE THYROID GLANDS OF CATTLE FROM THREE DIFFERENT DISTRICTS IN NORWAY, SUMMER 1974. Nyberg, O. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). Jan 1975. 25p. (In Norwegian). Dep. NTIS (US Sales Only) $4.25.

Investigations were carried out on weight, iodine concentration, and total iodine content in the thyroid gland in summer-fed cows from three different areas in Norway. The iodine measurements were made by neutron activation analysis. No difference in weight was found between the three areas. The iodine concentration in the glands from the Stavanger area was significantly higher than in the Oslo- and Tynset area. A comparison was made between the iodine content found in samples taken in the winter and the samples taken in the summer. In Stavanger and Tynset the iodine content was higher in the winter. Cows with extra supply of mineral fodder showed increased iodine content in the thyroid. (auth)

21818 (JUL-11(Bd.2), pp 19-33) NEUTRON-ACTIVATION ANALYSIS OF TRACES IN CONSTRUCTION AND RAW MATERIALS. Erdtmann, G.; Aboulwafa, O.; Weisleder, C.; Soyka, W.;

Petri, H.; Kayser, B.; Gatschke, W.; Mergler, H.; Christahl, C.; Nicolai, S. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

5 figs.; 5 tabs.; 5 refs. With abstract. Available from ZAED.

In workshop on modern analytical methods. Vol. II. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

A few applications of activation analysis are discussed by chosen examples from current works. (1) In high-grade lead, which was to be used as target material for a mass separator, mercury was found. (2) The quality of titanium dioxide reflector materials can be unfavorably influenced by certain trace elements. We have developed methods to determine Mn, As and V. (3) Bauxite can contain considerable amounts of uranium and thorium which are supposed to be enriched in the waste products of the production of aluminium. This was determined by using activation with epicadmium neutrons. (4) For a forensic investigation, it was necessary to compare trace element patterns of glass fragments. This could even be done with samples of a few μg using the instrumental multi-element activation analysis. (5) A large number of synthetics were investigated in order to be able to manufacture pneumatic dispatch carriers and other radiation containers from materials which are hard to activate. (auth)

21819 (JUL-11(Bd.2γ, pp 35-48) TRACE ANALYSIS WITH ACCELERATORS. Muenzel, H. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

9 figs.; 2 tabs.; 12 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. II. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

A report is given on the use of cyclic accelerators in a projectile energy region of about 10 to 60 MeV to activate trace impurities. Three irradiation variants, namely (a) the characteristic x-radiation of individual elements produced by the slowing-down of charged projectiles in the absorber material, (b) the scattering of charged projectiles and (c) the directly used nuclear reaction with charged particles or secondarily produced neutrons, are discussed indicating their advantages and specific problems. (GE)

21820 (JUL-11(Bd.3), pp 29-41) DETERMINATION OF POLLUTING ELEMENTS IN SOIL SAMPLES AND FLY ASH BY MEANS OF ACTIVATION ANALYSIS. Erdtmann, G.; Aboulwafa, O.; Mergler, H.; Weisleder, C.; Gueldenberg, G. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

7 figs.; 3 tabs.; 5 refs. With abstract. Available from ZAED.

In workshop on modern analytical methods. Vol. III. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

A separating process based on the principle of the displacement-column extraction was developed and applied for the determination of mercury in sewage sludge and other ground samples. The content of uranium and thorium in the fly ash of power plants was measured by epithermal neutron activation analysis. (auth)

21821 (JUL-1170) DETERMINATION OF VANADIUM, CHROMIUM, MANGANESE, AND ARSENIC IN TITANIUM DIOXIDE BY NEUTRON ACTIVATION ANALYSIS. Erdtmann, G.; Aboulwafa, O. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentrallabor fuer Chemische Analyse). Feb 1975. 60p. (In German). INIS.

For the determination of vanadium, chromium, manganese and arsenic in titanium dioxide several different neutron activation analysis procedures have been employed. Vanadium has been determined via ^{52}V after a short time irradiation of the hydrofluoric acid solution of titanium dioxide and extraction by N-benzoyl-N-phenylhydroxylamine. For the analysis of chromium the sample is dissolved in potassium disulfate, chromium is extracted and determined by γ-measurement of ^{51}Cr. Manganese can be measured by a γ-ray spectrometer after reactor irradiation without chemical separation. Arsenic has to be carefully separated, above all from antimony which is usually present in a large excess. This has been done by a newly developed column extraction procedure, so that ^{76}As can be measured without interference. The development of the procedures and the completion of the analyses are fully described. (auth)

21822 (NP-20444, pp 39) ANALYSIS OF RUBIDIUM: CESIUM RATIOS IN NATURAL SOURCES BY NEUTRON ACTIVATION. Purkayastha, B. C.; Aditya, S. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21823 (NP-20444, pp 39) USE OF ACTIVATION ANALYSIS IN PROSPECTING AND IN EVALUATING THE GEOCHEMICAL CHARACTERISTICS OF GOLD AND OTHER ASSOCIATED METALS. Das, N. R.; Bhattacharyya, S. N. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21824 (NP-20507, pp 137-140) STUDIES OF SOIL SAMPLES USING NEUTRON ACTIVATION AND X-RAY FLUORESCENCE ANALYSIS. Menke, H.; Weber, M. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21825 (NP-20508, pp 79-80) NONDESTRUCTIVE DETERMINATION OF THE NITROGEN (PROTEIN) CONTENT IN SINGLE KERNELS OF SEED. Sundqvist, B. (Tandem Accelerator Lab., Uppsala); Goenczi, L.; Koersner, I.; Bergman, R.; Lindh, U. Jan 1975.

In annual report, 1974.

(Tandemacceleratorlaboratoriet, Uppsala (Sweden)).

21826 (NP-20508, pp 81-82) ELEMENTAL ANALYSIS IN ORGANIC MATERIAL USING A COMBINATION OF (d,p) AND (d,α) REACTIONS AND DEUTERON-INDUCED X RAYS. Sundqvist, B.; Pihl, J.; Amten, L.; Glantz, L.; Morenius, B. (Tandem Accelerator Lab., Uppsala). Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

21827 (UCRL-51850) TRACE ELEMENTS IN CALIFORNIA AEROSOLS, Part I. Instrumental Neutron Activation Analysis Techniques. Ragaini, R. C.; Ralston, H. R.; Garvis, D.; Kaifer, R (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jun 1975. Contract W-7405-Eng-48. 46p. Dep. NTIS $4.00.

Instrumental Neutron Activation Analysis (INAA) done at LLL played a key role in the 1972-1974 California Aerosol Characterization Experiment (ACHEX), a major experiment in the chemistry of aerosols in urban and non-urban sites of California sponsored by the State of California Air Resources Board. The main purpose of INAA was to measure the particle size distributions and diurnal patterns of key chemical constituents in aerosols collected in California. These data were used to satisfy some of the key objectives of ACHEX, including aerosol characterization and evaluation of the origins and evolutions of aerosols. Secondary uses of INAA were the validations of the Lundgren rotating drum cascade impactors used in the ACHEX, and validations of other analytical techniques used in the chemical analyses. As a result of these studies, it was concluded that techniques using INAA were useful operational methods for chemical analysis of aerosols collected over two-hour periods in urban air with an active monitoring program. (auth)

21828 (UCRL-51859) INSTRUMENTAL TRACE ELEMENT ANALYSIS OF CALIFORNIA MARKET MILK. Ragaini, R. C.; Langhorst, A. L.; Ralston, H. R.; Heft, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Jun 1975. Contract W-7405-eng-48. 27p. Dep. NTIS $4.00.

Trace element analysis for 15 elements (Zn, Na, Br, Rb, Sr, Mg, Al, Ca, Cl, I, K, Fe, Co, Se, Cs) was carried out on 32 samples of California market milk and 6 samples of Colorado milk in a pilot study of toxic and nutrient trace elements in the soil-forage-cow-milk food chain. The techniques of instrumental neutron activation analysis and x-ray fluorescence analysis are described. Sample collection, preparation, analysis, and data reduction procedures are discussed. The mean values and variations of trace element concentrations in milk are compared to data from other studies. (auth)

21829 INCREASED ACTIVATION ANALYSIS ACCURACY WITH A LOW-BACKGROUND DETECTOR. Barabanov, I. R.; Gavrin, V. N.; Kuryshev, A. M.; Orekhov, I. V. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1286-1287(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 503(Dec 1974).

An extraction device is described for measuring Ca microimpurities through the activation method by separation and measurement of the ^{37}Ar formed from the ^{40}Ca (n,α) reaction. The counter is included in an anticoincidence system for subtraction of the cosmic-ray background. This device is to be used to determine the Ca impurity in a radiochemical experiment for detecting solar neutrinos. (DLC)

21830 SPATIAL DISTRIBUTION OF LEAD DISCERNED FROM α-TRACKS. Flerov, G. N.; Berzina, I. G.; Berman, I. B.; Mel'nikov, I. V. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1279-1281(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 499-500(Dec 1974).

Local Pb contents below 10^{-2} wt% can be determined in minerals by activation using 84-MeV C^{2+} ions; the resulting α-particle emission is recorded with a dielectric (cellulose nitrate) track detector. The sensitivity is 10^{-3} to 10^{-4} wt% and the resolution 10μ.

The method was tested on several specimens; the other elements which are also activated by the C^{2+} ions were found by x-ray microprobes to be below the level likely to interfere with the Pb determination. (DLC)

21831 METHOD AND APPARATUS FOR MEASURING THE CONCENTRATION OF WATER, IRON, AND ALUMINUM IN IRON ORE BY NEUTRON RADIATION. Holmes, R. J.; Wylie, A. W.; McCracken, K. G. (to Commonwealth Scientific and Industrial Research Organization). US Patent 3,889,112. 10 Jun 1975. Priority date 9 Jun 1972, Australia. 10p.

Techniques and apparatus for measuring the concentration of water and specific components in materials are described. The techniques involve irradiating the material with neutrons and monitoring the neutron flux in the vicinity of the irradiated material and the gamma radiation from excited nuclei of the specific component. Examples of the use of the invention include on-stream monitoring of ores carried by conveyor belts and borehole logging using a probe which carries a neutron source, and neutron and gamma radiation detectors. (auth)

21832 A NEW METHOD FOR PROTEIN ESTIMATION IN LARGE SEEDS USING FAST NEUTRON ACTIVATION TECHNIQUE. Rao, V. S.; Misra, S. C.; Gupta, U. C. (Bhabha Atomic Research Centre, Bombay (India)). pp 59-64 of Proceedings of the Chemistry Symposium, Aligarh, December 21-23 1972. Vol. I. Radioisotope Techniques for Chemical and Biomedical Applications, Nuclear and Radio Chemistry, and Radiation Chemistry. Bombay; Department of Atomic Energy (1974).

From chemistry symposium; Aligarh, India (21 Dec 1972). 4 refs., 2 figures.

A new method was developed for the determination of protein content of large seeds using powders of different nitrogen content. The powders were obtained by mixing glucose with amino acids in different proportions and were irradiated with and without the seeds in the 14-MeV neutron flux. The irradiated samples were counted under identical conditions and their activities were used to calculate the protein content of the seeds. The results were compared with those obtained by conventional activation technique and found to be in good agreement. This new method has the advantage of being nondestructive. (auth)

21833 INVESTIGATION OF SEMICONDUCTOR STRUCTURES USING BACKSCATTERING OF MeV PARTICLES. Barcz, A.; Turos, A.; Wielunski, L. (Inst. of Nuclear Research, Warsaw). Int. J. Appl. Radiat. Isot.; 26: No. 5, 227-232(May 1975).

Applications of backscattering of 1 to 2 MeV α-particles to the analysis of a variety of silicon structures have been investigated. This technique allows detection of medium- and heavy-mass impurities in light matrices, as well as non-destructive in-depth analysis of surface layers. (auth)

21834 ANALYTICAL CHEMISTRY OF THE ACTINIDE ELEMENTS. Veselskii, J. C. (International Atomic Energy Agency, Seibersdorf, Austria). 76: No. 2, 1-5(Feb 1975). (In German).

The methods for the preparation of actinide elements and their practical significance are briefly discussed. The techniques employed for the analytical determination of the actinides are then reviewed: conventional chemical methods, radiometric methods, activation analysis, as well as spectrophotometric and fluorimetric methods. Finally, techniques and problems in the separation of the actinides, especially by precipitation, ion exchange and solvent extraction, are described. (GG)

21835 DETERMINATION OF C, O, AND N IN HUMIC ACID FRACTIONS USING THE PHOTONUCLEAR REACTION. Kasymov, A. K.; Khakimov, M. (Tashkent State Univ.). Dokl. Akad. Nauk Uzb. SSR; No. 2, 25-26(1975). (In Russian).

Chemical analysis of 20% humic acid fractions showed, C, O, and N contents of 66.3, 28.4, and 1.26% while gamma-activation analysis showed 65.3, 28.2, and 1.47%. In the 30% fraction values were 69.5, 33.9, and 1.31% for chemical analysis and 64.9, 29.5, and 1.62% for gamma activation. (tr-auth)

21836 TRACE ELEMENTS IN COAL BY NEUTRON ACTIVATION ANALYSIS WITH RADIOCHEMICAL SEPARATIONS. Frost, J. K.; Santoliquido, P. M.; Camp, L. R.; Ruch, R. R. (Illinois State Geological Survey, Urbana). pp 84-97 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

Procedures for the determination of 11 elements in coal, Sb, As, Br, Cd, Cs, Ga, Hg, Rb, Se, U, and Zn, by neutron activation analysis with radiochemical separation are summarized. Separation techniques include direct combustion, distillation, precipitation, ion exchange, and solvent extraction. The evaluation of the radiochemical neutron activation analysis for the determination of mercury in coal used by the Bureau of Mines in its mercury round-robin program is discussed. Neutron activation analysis has played an important role in recent programs to evaluate and test analysis methods and to develop standards for trace elements in coal carried out by the National Bureau of Standards and the Environmental Protection Agency. (auth)

21837 TRACE ELEMENTS BY INSTRUMFNTAL NEUTRON ACTIVATION ANALYSIS FOR POLLUTION MONITORING. Sheibley, D. W. (Lewis Research Center, Cleveland). pp 98-117 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

Methods and technology were developed to analyze 1000 samples/yr of coal and other pollution-related samples. The complete trace element analysis of 20-24 samples/wk averaged 3-3.5 man-hours/sample. The computerized data reduction scheme could identify and report data on as many as 56 elements. In addition to coal, samples of fly ash, bottom ash, crude oil, fuel oil, residual oil, gasoline, jet fuel, kerosene, filtered air particulates, ore, stack scrubber water, clam tissue, crab shells, river sediment and water, and corn were analyzed. Precision of the method was +-25 percent based on all elements reported in coal and other sample matrices. Overall accuracy was estimated at 50 percent. (auth)

21838 MAJOR, MINOR, AND TRACE ELEMENT COMPOSITION OF COAL AND FLY ASH, AS DETERMINED BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS. Abel, K. H.; Rancitelli, L. A. (Battelle Pacific Northwest Labs., Richland, WA). pp 118-138 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

A highly sensitive instrumental neutron activation analysis (INAA) technique can determine 30 to 40 elements in coal and fly ash including Sb, As, Se, Hg, Zn, and V which are elements of environmental concern. This multi-element capability makes possible the detailed chemical analysis of coal and combustion products. A comparison to National Bureau of Standards–Environmental Protection Agency fuel standards shows that a high degree of accuracy and precision is attainable, allowing tentative conclusions to be drawn as to the origin of certain elements in the coal and their fate during combustion. (auth)

21839 TRACE ELEMENT MASS BALANCE AROUND A COAL-FIRED STEAM PLANT. Bolton, N. E.; Carter, J. A.; Emery, J. F.; Feldman, C.; Fulkerson, W.; Hulett, L. D.; Lyon, W. S. (Oak Ridge National Lab., TN). pp 175-187 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

Mass balance measurements for 41 elements have been made around the Thomas A. Allen Steam Plant in Memphis, Tenn. For one of the three independent cyclone boilers at the plant, the concentration and flow rates of each element were determined for coal, slag tank effluent, fly ash in the precipitator inlet and outlet (collected isokinetically), and fly ash in the stack gases (collected isokinetically). Measurements by neutron activation analysis, spark source mass spectroscopy (with isotope dilution for some elements), and atomic adsorption spectroscopy yielded an approximate balance (closure to within 30 percent or less) for many elements. Exceptions were those elements such as mercury, which form volatile compounds. For most elements in the fly ash, the newly installed electrostatic precipitator was extremely efficient. (auth)

21840 ACTIVATION ANALYSIS OF SEMICONDUCTOR SILICON. Bereznai, T.; Zanati, T.; Bogancs, J. Magy. Kem. Foly.; 81: No. 3, 134-139(1975). (In Czech).

Neutron activation analysis and Ge(Li) spectrometry were used for the determination of doping elements and some undesirable impurities in the different layers of silicon slices used in transistor and integrated circuit technology. A short description of the method developed is given and its applicability is illustrated. (auth)

21841 SELECTIVE ENRICHMENT OF TRACE ELEMENTS USING AN ANILINE SULFUR RESIN. I. Preconcentration of Mercurials for the Purpose of Trace Analysis, e.g., NAA. Kraemer, H. J.; Niedhart, B. (Technische Hochschule, Darmstadt, Ger.). Radiochem. Radioanal. Lett.; 22: No. 3, 209-220 (15 Aug 1975).

An aniline sulfur resin (ASH) was found to be an effective matrix for the selective preconcentration of dissolved $Hg(NO_3)_2$ and CH_3HgCl from aqueous solutions at ppm levels. It could be demonstrated that almost 100% of the dissolved mercury compounds is retained by the ASH matrix which has a capacity of about 120 mg Hg/g ASH. In the case of an excess of sodium (as $NaNO_3$) and selenium (as Li_2SeO_3) in the solution, mercury can be separated from these elements and enriched easily by a factor of 10^3 and 10^2 resp.. The ASH matrix with the above properties is particularly applicable to the trace analysis of surface waters by in situ preconcentration of the mercurials, followed by an analytical determination method (preferably NAA). (auth)

21842 INVESTIGATION OF CORROSION OF ALLOYS USING NEUTRON ACTIVATION AND GAMMA-RAY SPECTROMETRY. I. Principle of the Method and Its Testing on Dental Amalgams. Alian, A.; Hassanein, E.; El-Sharkawi, A. (Atomic Energy Establishment, Cairo). Radiochem. Radianal. Lett.; 22: No. 3, 185-194(15 Aug 1975).

A simple procedure is proposed for studying differential (selective) corrosion of alloys using the radioactive tracer technique. This procedure is based on the neutron activation of samples, and the measurement of the γ-ray spectra of irradiated samples and their corrosion products. The reliability of the given method has been demonstrated by application to conventional and spheroidal dental amalgams. The method can produce useful results for studying the various factors affecting the properties of dental amalgams as well as other alloys. (auth)

21843 VERIFICATION OF THE BIOLOGICAL PROPERTIES OF Au-195 LABELED GOLD SODIUM THIOMALATE BY ACTIVATION ANALYSIS. Smith, E. M.; Smith, P. M.; Gottlieb, N. L. (Univ. of Miami, FL). J. Nucl. Biol. Med.; 19: No. 1, 32-35 (1975).

Radioactive Au-195 labeled Myochrysine (gold sodium thiomalate) and stable Au-197 Myochrysine were simultaneously administered to patients with rheumatoid arthritis to study the pharmacodynamics of gold. To verify the biological and chemical equivalence of the gold contained in the labeled and unlabeled compounds, test doses of these agents were administered to four patients who had not previously received chrysotherapy. The patients were hospitalized on a metabolic ward for a minimum of ten days during which urine, fecal, whole blood and serum specimens were collected. Stable and radiogold content in these specimens were measured by neutron activation analysis and scintillation counting, respectively. The ratio of stable gold to radiogold was constant with time in all specimens, demonstrating biological and chemical equivalence of these compounds, and the value of neutron activation analysis in verifying metabolic properties of tracer compounds. (auth)

21844 DETERMINATION OF AIR POLLUTANTS WITH THE ACCENT ON NUCLEAR CHEMICAL ANALYSIS. Lesny, J.; Tolgyessy, J. (Slovak Technical Univ., Bratislava). Chem. Listy; 69: No. 7, 703-729(Jul 1975). (In Czech).

Nuclear analytical methods are discussed from the point of view of their utilizability in the analysis of air pollutants. From the analysis it is evident that some methods (use of radioactive kryptonates in automatic analyzers, application of activation analysis, x-ray fluorescence methods) are already so theoretically elaborated and practically tested that they can be widely used in practice in the near future, for the control of the environment. Many other methods are becoming important in the solution of single specific problems of the protection of the environment (for example the control of a sudden environmental contamination in the proximity of chemical plants and industrial centers). (auth)

21845 DETERMINATION OF RHENIUM IN MOLYBDENUM AND TUNGSTEN BY NEUTRON ACTIVATION. Samadi, A. A.; Ailloud, P.; Fedoroff, M. (Centre d'Etudes de Chimie Metallurgique, Vitry, France). Anal. Chem.; 47: No. 11, 1847-1849 (Sep 1975).

Rhenium was determined in Mo and W by thermal neutron activation analysis and radiochemical separation. The nuclear reaction used is $^{187}Re(n,gamma)^{188}Re$. After the activation, rhenium was extracted in acetone from a basic aqueous solution. In the case of the analysis of Mo, an additional separation of Tc from Re is necessary, and was accomplished by using an anion exchange resin in a medium containing HCl and NH_4SCN. Radioactivity measurements were made on the 155 keV gamma ray using a Ge–Li detector coupled to a pulse height analyzer. In the case of Mo, precision was about +-5 percent; for W, it reached +-20 percent because of the very low concentrations. (JGB)

21846 GAMMA-RAY TABLES FOR NEUTRONS, FAST-NEUTRON, AND PHOTON ACTIVATION ANALYSIS. II. List of All the Gamma-Rays for All Isotopes in Order of Increasing Energy. Lis, S. A. (State University Coll., Fredonia, NY); Hopke, P. K.; Fasching, J. L. J. Radioanal. Chem.; 25: No. 2, 303-428(1975).

Gamma-rays for all isotopes are listed in order of increasing energy. Column one lists the gamma-ray energies in keV while the relative intensity of each gamma-ray is found in column two. The isotope that emits the gamma-ray is identified in column three and the half-life of the isotope is given in column four. Other gamma-rays associated with the decay of the isotope are listed in column five. The remaining columns give the means of production of the isotope emitting the listed gamma-ray. (auth)

21847 USE OF INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS FOR THE DETERMINATION OF ARSENIC CONCENTRATIONS IN POULTRY. Bolton, B. A.; Hopke, P. K. (State Univ. Coll., Fredonia, NY). J. Radioanal. Chem.; 25: No. 2, 299-302(1975).

Arsenic was determined in uncooked chicken and poultry parts by neutron activation analysis. These analyses indicate that arsenic concentrations in poultry can be measured at levels below the mandatory maximum levels of arsenic in poultry, 0.5 ppM for uncooked muscle tissue and eggs, and 2.0 ppM for uncooked edible by-products. (JGB)

21848 ANALYSIS OF PHOSPHORUS AND CHLORINE IN NATURAL WATERS BY ALPHA-PARTICLE ACTIVATION. Vis, R. D.; Verheul, H. (Univ., Amsterdam). J. Radioanal. Chem.; 25: No. 2, 293-297(1975).

Activation by 16 MeV α-particles was used for the quantitative analysis of P and Cl in natural waters with a reproducibility of ±5%. Limits of detection of 0.1 and 0.4 ppM were obtained for the two elements, respectively. The method is applied to the determination of P and Cl in water samples taken in the environment of Amsterdam. (auth)

21849 ISOTOPIC ANALYSIS OF BORON BY THE COINCIDENT MEASUREMENT OF COMPLEMENTARY PARTICLES. Coetzee, P. P.; Pretorius, R.; Peisach, M. (Southern Universities Nuclear Inst., Faure, South Africa). J. Radioanal. Chem.; 25: No. 2, 283-292(1975).

The coincident measurement of both nuclear reaction products at their complementary angles was used for the isotopic analysis of boron by the reactions $^{10}B(d,p)^{11}B$ and $^{11}B(d,\alpha)^{9}Be$. Both isotopes were determined simultaneously with a relative standard deviation of ±2.5%. (auth)

21850 FLUORINE STANDARDS FOR ACTIVATION ANALYSIS. Mitchell, J. W.; Bloom, E. Jr.; Gooden, C. E. (Bell Telephone Labs., Murray Hill, NJ). J. Radioanal. Chem.; 25: No. 2, 221-226(1975).

Stoichiometric, stable fluorides for comparison standards in neutron activation analysis were prepared by horizontal zone-refining or sublimation in HF atmospheres. The fluorides of Na, Mg, and Al were found by thermogravimetry to be anhydrous and to remain water-free after exposure to room air. Fluorine in the purified samples was separated by the pyrohydrolysis method and subsequently measured by acid-base titrimetry or selective ion electrodes. Deviations from theoretical values were ±0.1, ±0.9 and ±2.8% respectively for fluorides of Na, Mg, and Al. (auth)

21851 ANALYSIS OF ORGANICALLY BOUND MERCURY VIA NEUTRON ACTIVATION ANALYSIS. Buenafama, H. D.; Lubkowitz, J. A. (Instituto Venezolano de Investigaciones Cientificas, Caracas). J. Radioanal. Chem.; 25: No. 2, 239-246(1975).

An accurate, combined extraction–neutron activation technique for the analysis of organomercurials in biological samples at ppB levels is presented. Detection limits of 5 ng of methyl mercury chloride can be easily achieved in analyzing fresh and canned tuna fish. No interferences of Hg, P, Br, and Na were observed. (auth)

21852 ANALYTICAL CHEMISTRY OF THE ACTINIDE ELEMENTS. Veselsky, J. C. (International Atomic Energy Agency, Seibersdorf, Austria). Oesterr. Chem.-Z.; 76: No. 2, 1-5(Feb 1975). (In German).

The methods for the preparation of actinide elements and their practical significance are briefly discussed. The techniques employed for the analytical determination of the actinides are then reviewed: conventional chemical methods, radiometric methods, activation analysis, as well as spectrophotometric and fluorimetric methods. Finally, techniques and problems in the separation of the actinides, especially by precipitation, ion exchange and solvent extraction, are described. (INIS)

Chemical and Spectral Procedures

Refer also to abstracts 22032, 22299, and 22368.

21853 (AED-CONF-74-497-004) ADVANCES IN THE CONTINUOUS DETECTION OF SIGNIFICANT CATIONS AND ANIONS IN THE RANGE OF TRACE AMOUNTS. Ammer, H. (Ammer Automatik GmbH, Gueglingen (F. R. Germany). Jan 1975. 27p. (In German). INIS.

From VGB conference on chemistry in the power plant 1974. VGB feed water conference 1974; Essen, F. R. Germany (29 Oct 1974).

The task of a continuous ion determination, the information contents of the ion concentration, the determination of the ion concentration by measuring the potential, the definition of the reference solution and the defined fluidized bed ion exchange as well as the physical-chemical sodium detection by reference

fluidized bed exchanger are treated and clarified by examples of application for selective difference measurements. (GE)

21854 (IEA-367) SEPARATION OF ZINC AND PALLADIUM TRACES FROM URANIUM BY EXTRACTION WITH TRI-N-OCTYLAMINE. Direct Determination in the Organic Phase by Atomic Absorption. de Moraes, S.; Cipriani, M.; Abrao, A. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Dec 1974. 7p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

A procedure is described for the extraction and determination of Zn and Pd as traces from nuclear grade uranium (ADU, UO_2, UO_3, U_3O_8). The elements are extracted from UO_2Cl_2–HCl–KI solution with tri-n-octylamine in benzene and determined by atomic absorption spectrophotometry. The addition of potassium iodide to the UO_2Cl_2–HCl solutions improved the extraction of both elements. Direct burn of the organic phase in the atomic absorption spectrophotometer using hydrogen–air flame provided enhancement of the absorbance for both elements. The relative standard deviations were Zn, 3% and Pd, 2.9%. (auth)

21855 (JUL-11(Bd.1), pp 5-25) ANALYTICAL CHEMISTRY OF NUCLEAR FUELS. von Baeckmann, A. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

1 fig.; 1 tab.; 10 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. I. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

A survey is given of the significance of chemical analysis in the characterization of nuclear fuels regarding their uranium, thorium, and plutonium content, isotope composition, chemical form, etc., at each point of the nuclear fuel cycle (e.g., ore processing, fuel element fabrication, reprocessing, waste). A detailed table is given on the usual methods, their field of application, accuracy as well as costs of the analysis and on the description in the literature. (GE)

21856 (JUL-11(Bd.2), pp 59-73) ISOTOPIC ANALYSIS BY MEANS OF EMISSION SPECTROSCOPY. Mainka, E.; Mueller, H. G. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F.R. Germany (15 Oct 1973).

10 figs. Available from ZAED.

In workshop on modern analytical methods. Vol. II. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

The fundamentals of emission spectroscopic isotope analysis are the differences in the nuclear masses and nuclear volumes of the individual isotopes which lead to an isotope shift in the terms and thus to shifting of the lines in the optic spectrum. The differences in wavelength for uranium isotopes in the spectral region of 4,000 to 6,000 Angstroem are of the order of 50 to 100 milli-Angstroem, those for plutonium isotopes between 75 and 25 milli-Angstroem. This means that the spectral apparatus must have a high resolution power. Influencing factors such as intensity effects on neighboring lines and influence of the excitation source, are discussed. (GE)

21857 (JUL-11(Bd.2), pp 75-89) MASS SPECTROMETRIC ANALYSIS OF HIGH-PURITY MATERIALS AND ISOTOPE RATIO MEASUREMENT OF GEOCHEMICAL SYSTEMS. Beske, H.; Dongmann, G.; Holzbrecher, H.; Melchers, F. G. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F.R. Germany (15 Oct 1973).

11 figs.; 11 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. II. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

Two examples of mass spectrometry used analytically are described: (1) the simultaneous determination of numerous elements in a concentration >0.1 ppm (>1 ppb in extreme cases) in pure materials (metals and graphite) and (2) the determination of the oxygen isotope ratio $^{18}O/^{16}O$ in connection with the photosynthesis in leaves of transpiring plants. The functioning of the spark-MS and the secondary ions-MS is explained and the advantages and disadvantages of the method are discussed. (GE)

21858 (NP–20444, pp 41) SPECTROPHOTOMETRIC DETERMINATION OF PERIODATE. Kundu, K. P.; Bardham, D. K.; Bhattacharyya, S. N. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21859 (PB-235901) SHOCK TUBE STUDIES OF DEUTERIUM DISSOCIATION AND OXIDATION BY ATOMIC RESONANCE ABSORPTION SPECTROPHOTOMETRY. Appel, D.; Appleton, J. P. (Massachusetts Inst. of Tech., Cambridge (USA). Fluid Mechanics Lab.). May 1974. 36p. NTIS $3.75.

The technique of atomic resonance absorption spectrophotometry (ARAS) was used to measure deuterium atom concentration profiles in the reaction zones behind both primary and reflected shock waves. Calibration of the ARAS technique over a wide range of D atom concentrations enabled accurate rate measurements to be made of the dissociation reaction: $D_2 + Ar$ to $D + D + Ar$, over the temperature range 1800 to 4000°K. The rates of other reactions which included the isotope exchange reactions: $H_2 + D$ to $HD + H$ and $D_2 + H$ to $HD + D$, and the sequence of oxidation reactions: $O_2 + D$ to $OD + O$, $D_2 + O$ to $OD + D$, and $D_2 + OD$ to $D_2O + D$, were also studied at temperatures in the range 1700 to 3100°K. (auth)

21860 (RD/B/N-3210) ASSESSMENT OF LASER RAMAN SPECTROSCOPY FOR MATERIALS SCIENCE STUDIES. Channing, D. A.; Allen, G. C. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 33p. Dep. NTIS (US Sales Only) $4.75.

An assessment has been made of laser Raman spectroscopy with a view to gaining an appreciation of the technique for materials science research. Measurements are described of Raman spectra which were made on a wide range of samples, including many oxides. The overall performance of the two spectrometers used (i.e., the double monochromator Cary 83 and the triple monochromator Cary 82) are compared and an indication is given of some possible areas of application of the technique at BNL. (auth)

21861 RELATIVE SENSITIVITY OF DIRECT ATOMIC ABSORPTION DETERMINATION OF ELEMENT TRACE AMOUNTS IN FLAME. Prudnikov, E. D. (Leningradskij Gosudarstvennyj Univ. (USSR). Kafedra Analiticheskoj Khimii). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 10, 1489-1491(1974). (In Russian).

The method of pulsed volatilization of samples in flames with measurement of the absorption in the adapter was used for the direct determination of traces of elements in different materials such as very pure reagents and rocks. The relative sensitivity of the determination was 10^{-5} to 10^{-6} for Cd, Zn, Ag, Pb, Be, Cu, Hg, Se, Sb, and other elements in sample weights up to 10 mg. (tr-auth)

21862 CONTRIBUTIONS TO THE ANALYSIS OF NUCLEAR RAW MATERIALS. VII. Spectrophotometric Determination of Ni in U_3O_8 and Yellow Cake Samples. Korkish, J.; Hubner, H. (Analytisches Institut der Universitat, Vienna). Mikrochim. Acta; 2: No. 2, 219-226(Aug 1975). (In German).

A method is described which is suitable for separating nickel from large amounts of uranium and making the spectrophotometric end-determination accessible. The separation of the nickel from the uranium matrix is conducted by means of adsorption on a column of the strongly acidic cation-exchanger Dowex 50 X8 from a mixture of 95 vol% tetrahydrofuran and 5 vol% of 12 M nitric acid, which also is 0.1 M with respect to trioctyl-phosphine oxide. Following the elution with 6 M hydrochloric acid, the nickel is separated by chloroform extraction of its dimethylglyoxime complex from the coeluted foreign ions. After the back-extraction with 1 M hydrochloric acid, the nickel is determined spectrophotometrically with application of the dimethylglyoxime method. The procedure was used for the determination of nickel in U_3O_8 standard specimens (0.64 to 23.3 ppM Ni) and Yellow Cake (25.0 to 58.0 ppM Ni). Excellent agreement was attained in the findings in all instances. (auth)

21863 TRACE IMPURITIES IN COAL BY WET CHEMICAL METHODS. Pollock, F. N. (Kennecott Copper Corp., Lexington, MA). pp 23-34 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

In determining trace elements in coal by wet chemical methods, conventional atomic absorption spectroscopy (AAS) was used to determine Li, Be, V, Cr, Mn, Co, Ni, Cu, Zn, Ag, Cd, and Pb after dry ashing and acid dissolutions. A graphite furnace accessory was used for the flameless AAS determination of Bi, Se, Sn, Te, Be, Pb, As, Cd, Cr, Sb, and Ge. Mercury can be determined by flameless AAS after oxygen bomb combustion. Arsenic and antimony can be determined as their hydrides by AAS after low temperature ashing. Germanium, tin, bismuth, and tellurium can be determined as their hydrides by AAS after high temperature ashing. Selenium can be determined as its hydride by AAS after a special combustion procedure or after oxygen bomb combustion. Fluorine can be determined by specific ion analysis after oxygen bomb combustion. Boron can be determined colorimetrically. (auth)

21864 TRACE ELEMENTS IN COAL BY OPTICAL EMISSION SPECTROSCOPY. Dreher, G. B.; Schleicher, J. A. (Illinois

State Geological Survey, Urbana). pp 35-47 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

Two quantitative emission spectrochemical methods, direct-reading and photographic, were developed to analyze 16 trace elements in high-temperature coal ash. Problems such as possible loss of vanadium and molybdenum by volatilization and an apparent increase in boron concentration with increasing ashing temperature were encountered in ashing coal samples. Because natural and/or analyzed standards were unavailable, synthetic standards were prepared for the direct-reading method. U.S.G.S. standard granite G-2 and iron oxide were combined with various amounts of a mixture of silica, alumina, and 1000 ppM of each of the trace elements of interest. For the photographic method, similar mixtures were prepared without the G-2 base. For each element, usable concentration limits, concentration ranges on the coal basis calculated from the coal ash samples, and the resulting standard deviations were determined. (auth)

21865 MAJOR AND MINOR CONSTITUENTS IN SILICEOUS MATERIALS BY ATOMIC ABSORPTION SPECTROSCOPY. Muter, R. B.; Nice, L. L. (West Virginia Univ., Morgantown). pp 57-65 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

Siliceous materials, Si, Al, Fe, Ti, Ca, Mg, Na, K, Mn, Ni, Ba, Ag, Au, Ca, Cr, Cu, Ga, In, Mo, Sb, and Zn, may be analyzed by a lithium tetraborate fusion-acid dissolution technique using atomic absorption spectroscopy. Mercury, tin, and lead volatilize by this technique, and gold and silver in concentrations above 0.5 wt percent cannot be held in solution. Coal ash is preconcentrated prior to analysis, and there is possible silica interference. Analytical results, where possible, are compared statistically with other reported values. (auth)

21866 TRACE IMPURITIES IN FUELS BY ISOTOPE DILUTION MASS SPECTROMETRY. Carter, J. A.; Walker, R. L.; Sites, J. R. (Oak Ridge National Lab., TN). pp 74-83 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

Spark spark (SSMS) and thermal emission (TEMS) mass spectrometry are used to determine ppB and ppM quantities of elements in energy sources such as coal, fuel oil, and gasoline. Toxic metals, cadmium, mercury, lead, and zinc, may be determined by SSMS with an estimated precision of +-5 percent, and metals that ionize thermally may be determined by TEMS with an estimated precision of +-1 percent using the isotope dilution technique. An environmental study of the trace element balance from a coal-fired steam plant was done by SSMS using isotope dilution to determine the toxic metals and a general scan technique for 15 other elements using chemically determined iron as an internal standard. In addition, isotope dilution procedures for the analysis of lead in gasoline and uranium in coal and fly ash by TEMS are presented. (auth)

21867 BROMOPYROGALLOL RED AS A REAGENT FOR PHOTOMETRIC DETERMINATION OF Te. Shitareva, G. G.; Poluektova, E. N.; Nazarenko, V. A. (Inst. of General and Inorganic Chemistry, Odessa). Zh. Anal. Khim.; 30: No. 6, 1166-1169(Jun 1975). (In Russian).

The reaction was studied between Te(IV), bromopyrogallol red (BPR), and diphenylguanidine (DPG). It has been shown that two complexes are formed. A compound with a ratio Te : BPR : DPG = 1 : 2 : 2 is formed in the presence of an excess of the reagents; $\epsilon_{545} = 5.7 \times 10^4$. This complex can be used for photometric determination of tellurium after its separation from interfering elements. The formation of the second complex (absorption maximum is at 530 nm) has been used for directly determining Te (down to 10^{-3}%) in H_2SeO_3. (auth)

21868 AMPEROMETRIC STUDY OF A COMPLEX OF Mo WITH N-ACETYLSALICYLOYL-N-PHENYLHYDROXYLAMINE. Gallai, Z. A.; Sheina, N. M.; Polikarpova, N. V.; Pleshakova, T. V. (Moscow State Univ.). Zh. Anal. Khim.; 30: No. 6, 1148-1152(Jun 1975). (In Russian).

Conditions for the formation and the composition of a complex of Mo with N-acetylsalicyloyl-N-phenylhydroxylamine (APHA) have been established amperometrically over a wide range of the solution acidity. Over the acidity range 2 M H_2SO_4—pH 5, Mo(VI) forms a complex with APHA with a constant ratio of Mo to the reagent to be 1 : 2. An amperometric method has been developed for determining 2.6×10^{-4} to 2.6×10^{-3} g-ion/l of Mo(VI) on a rotating graphite microelectrode using APHA as the titrant. 100-fold amounts of Co, Ni, Cr(III), Mn(II), Cu(II), Zn, V(IV), Mg, Co, Pb, Bi(III), Sn(IV); 50-fold amount of Al; 8-fold amount of Ti(IV); and 6-fold amount of W(VI) do not interfere. In the presence of hydroxyethylenediphosphonic acid, 100-fold amount of Fe(III) does not interfere. (auth)

21869 DETERMINATION OF Sb, Bi, AND Te IN AFFINATED Ag BY INVERSION VOLTAMMETRY. Gornostaeva, T. D.; Pronin, V. A. (Scientific-Research Inst. of Rare and Nonferrous Metals, Irkutsk, USSR). Zh. Anal. Khim.; 30: No. 6, 1139-1147 (Jun 1975). (In Russian).

A procedure was developed of inversion voltammetric determination of Sb Bi, and Te in affinated Ag by using extraction separation of the elements with diethyl ether, sulfide, and dibutylsulfide respectively. The sensitivity is 5×10^{-6}%, the coefficient of variation is 12 to 18%. (auth)

21870 DETERMINATION OF As, Se, AND Te BY INVERSION VOLTAMMETRY ON GRAPHITE ELECTRODES. Neiman, E. Ya.; Ponomarenko, G. B. (Scientific-Research and Design Inst. of Alloys and Non-Ferrous Metal Working, Moscow). Zh. Anal. Khim.; 30: No. 6, 1132-1138(Jun 1975). (In Russian).

The simultaneous discharge-ionization of arsenic, selenium, and tellurium with copper on graphite electrodes was examined by inversion voltammetry. It is shown that the simultaneous electrodeposition leads to formation of compounds which electrooxidation currents can be used to determine arsenic, selenium, and tellurium by inversion voltammetry. (auth)

21871 POLAROGRAPHIC DETERMINATION OF Np IN ITS HIGHEST OXIDATION STATES. Peretrukhin, V. F.; Alekseeva, D. P.; Krot, N. N. Zh. Anal. Khim.; 30: No. 6, 1127-1131(Jun 1975). (In Russian).

A polarographic method is described of analysis of Np(VII), Np(VI), and Np(V) as well as mixtures Np(VII) + Np(VI), Np(VI) + Np(V) in 4.0 to 4.5 M NaOH at a rotating platinum microelectrode. At Np concentration (at any high oxidation state) = $5 \cdot 10^{-5}$ to $4 \cdot 10^{-3}$ M, the method precision is 3 to 5%. In the determination of small amounts ($5 \cdot 10^{-5}$ M) of one valence form in the presence of a large amount (about 10^{-3} M) of another one, the mean square error increases up to 7%. Nitrate, sulfate, and uranyl ions do not interfere. The presence of Pu(VI) and Pu(V) complicates the polarogram analysis. (auth)

21872 POLYHYDROXYFLAVONES AS EXTRACTANTS. V. Extraction of a Complex of Th with Morin. Successive Extraction—Photometric Determination of Zr and Th. Blank, A. B.; Mirenskaya, I. I.; Satanovskii, L. M. (All-Union Scientific-Research Inst. of Single Crystals, Scintillation Materials, and Special Purity Chemicals, Kharkov). Zh. Anal. Khim.; 30: No. 6, 1116-1121(Jun 1975). (In Russian).

Thorium forms a cationic complex (from a Th^{4+} ion and a singly charged morin anion) at the component ratio 1 : 3. The complex is extracted with isoamyl alcohol as the ion associate with the perchlorate ion. The complex molar absorptivity in the organic phase, its two-phase stability constant, and extraction constant have been determined. A procedure has been worked out of successive extraction-photometric determining Zr and Th from one sample. The procedure was used for the analysis of mineral salt. (auth)

21873 DETERMINATION OF Ho IN A MIXTURE WITH Yb BY USING BROMOPYROGALLOL RED AND CETYLPYRIDINIUM BROMIDE. Poluektov, N. S.; Lauer, R. S.; Ovchar, L. A.; Potapova, S. F. (Inst. of Organic and Inorganic Chemistry, Odessa). Zh. Anal. Khim.; 30: No. 6, 1106-1109(Jun 1975). (In Russian).

The rare earths form iso-butanol-extractable three-component complexes with bromopyrogallol red and cetylpyridinium. Washing the extracts with iminodiacetic acid leads to partial decomposition of the Er, Tu, and Y complexes and to complete decomposition of Yb and Lu ones. The complexes of other elements (La to Ho) are not decomposed. A procedure is suggested for determining Ho in a mixture with Yb with a sensitivity 1 to 2% Ho_2O_3 in a mixture of Ho_2O_3 and Yb_2O_3. (auth)

21874 THERMOMETRIC TITRATION OF A FREE ACID AND URANYL IN SOLUTIONS OF SPENT FUEL ELEMENTS. Zamek, M. (Institut fuer Kernforschung, Prague); Strafelda, F. Collect. Czech. Chem. Commun.; 40: No. 6, 1888-1891(Jun 1975). (In German).

A method was developed for the determination of HNO_3 in addition to uranyl nitrate in aqueous and non-aqueous solutions by thermometric titration. An aqueous pyridine solution was used as the titrating reagent and determination of the uranyl was made by hydrogen peroxide additions in excess by additional titrations with the same reagent. Mg does not interfer with the determination even in hundred-fold excess. This method was developed for the operational analysis of solutions in the extractive processing of spent fuel elements in the presence of small amounts of Pu and fission products. The reproducibility and accuracy of the method is variable from tenths of a percent to percent according to the concentration of the components to

be determined. The method is usable for a sample volume of 0.1 to 10 ml in concentrations from 10^{-3} to 1M. (tr-auth)

21875 MULTIELEMENT ANALYSIS VIA COMPUTER-CONTROLLED RAPID-SCAN ATOMIC FLUORESCENCE SPECTROMETER WITH A CONTINUUM SOURCE. Johnson, D. J.; Plankey, F. W.; Winefordner, J. D. (Univ. of Florida, Gainesville). Anal. Chem.; 47: No. 11, 1739-1743(Sep 1975).

A versatile, simple, relatively inexpensive computer-controlled, slewed-scan spectrometer with a single EIMAC xenon arc excitation source, and an acetylene (air or N_2O) flame is described and used for multielement analysis of trace wear metals in jet engine lubricating oils. Analytical figures (detection limits and analytical curves) of merit obtained for 18 elements (Ag, Au, Cd, Cr, Co, Cu, Fe, In, Mg, Mn, Ni, Pb, Pd, Pt, Sn, Sr, Ti, Zn) measured with a separated air/acetylene flame and the EIMAC source and for 5 elements (Al, Be, Mo, Ti, and V) with a separated N_2O/acetylene flame and the same EIMAC source are listed. Despite the use of compromised experimental conditions, the detection limits obtained with this system are comparable to the best values obtained by flame atomic absorption spectrometry with single element hollow cathode lamps. The speed and flexibility of the system are demonstrated with respect to the analysis of 5 elements (Fe, Mg, Cu, Ag, and Cr) in jet engine lubricating oils; the measurement of these five elements in a given oil sample required about 1 min and the results compared with the Air Force average values obtained by about 50 laboratories. (auth)

21876 NUMERICAL MATRIX CORRECTION TECHNIQUE FOR THE MEASUREMENT OF TRACE ELEMENTS IN PLANT MATERIALS BY X-RAY FLUORESCENCE SPECTROMETRY. Reuter, F. W. III. (Agricultural Research Service, Berkeley, CA). Anal. Chem.; 47: No. 11, 1763-1766(Sep 1975).

A numerical matrix correction technique is used to linearize fluorescent x-ray intensities from plant material to permit quantitation of the measurable trace elements. Percentage accuracies achieved on a standard sample are +-13 percent for sulfur and phosphorus and better than +-10 percent for heavier elements. The calculation employs all the elemental x-ray intensities from the sample, relative x-ray production probabilities of the elements determined from thin film standards, elemental x-ray attenuation coefficients, and the areal density of the sample (mg/cm^2). The mathematical treatment accounts for the matrix absorption effects of pure cellulose and deviations in the matrix effect caused by the measured elements. Ten elements are typically calculated simultaneously, e.g., P, S, Cl, K, Ca, Mn, Fe, Cu, Zn, and Br. Detection limits obtained using a rhodium x-ray tube and an energy dispersive x-ray fluorescence spectrometer are in the low ppM range for the elements manganese to strontium. (auth)

21877 NOVEL ION EXCHANGE CHROMATOGRAPHIC METHOD USING CONDUCTIMETRIC DETECTION. Small, H. (Dow Chemical Co., Midland, MI); Stevens, T. S.; Bauman, W. C. Anal. Chem.; 47: No. 11, 1801-1809(Sep 1975).

Ion exchange resins have a well known ability to provide excellent separation of ions, but the automated analysis of the eluted species is often frustrated by the presence of the background electrolyte used for elution. A novel combination of resins succeeded in neutralizing or suppressing this background without significantly affecting the species being analyzed which in turn permits the use of a conductivity cell as a universal and very sensitive monitor of all ionic species either cationic or anionic. Using this technique, automated analytical schemes were devised for Li^+, Na^+, K^+, Rb^+, Cs^+, NH_4^+, Ca^{2+}, Mg^{2+}, F^-, Cl^-, Br^-, I^-, NO_3^-, NO_2^-, SO_4^{2-}, SO_3^{2-}, PO_4^{3-} and many amines, quaternary ammonium compounds, and organic acids. Elution time can take as little as 1.0 min/ion and is typically 3 min/ion. Ions were determined in a diversity of backgrounds, e.g., waste streams, various local-surface waters, blood serum, urine, and fruit juices. (auth)

21878 SENSITIVE EMISSION SPECTROMETRIC METHOD FOR THE ANALYSIS OF AIRBORNE PARTICULATE MATTER. Sugimae, A. (Environmental Pollution Control Center, Osaka). Anal. Chem.; 47: No. 11, 1840-1843(Sep 1975).

A rapid and sensitive emission spectrometric method for the routine analysis of airborne particulate matter collected on the glass fiber filter is reported. The method is a powder-dc arc technique involving no chemical pre-enrichment procedures. The elements--Ag, Ba, Be, Bi, Cd, Co, Cr, Cu, Fe, Ga, La, Mn, Ni, Pb, Sn, V, Y, Yb, and Zn--were determined. (auth)

21879 2,2'-[2,6-PYRIDINEDIYLBIS(METHYLIDYNENITRILO)]-DIPHENOL: A HIGHLY SELECTIVE REAGENT FOR THE DETECTION OF U(VI), Sb(III), AND Bi(III). Thabet, S. K.; Adrouni, S. M.; Taylm, H. A. (American Univ., Beirut). Anal. Chem.; 47: No. 11, 1870-1871(Sep 1975).

In an investigation to develop new specific and sensitive reagents for the detection of U(VI), Sb(III), and Bi(III), various chelating agents were tried. The chelating agent which gave the most satisfactory results was the Schiff base 2,2'-[2,6-pyridinediylbis-(methylidynenitrilo)]diphenol (I) obtained from the condensation of 2,6-pyridinedicarboxaldehyde with o-aminophenol. This reagent gave intense red products with Bi(III), Sb(III), and U(VI) in acidic medium. Further application of I proved it to be a highly selective reagent for the detection of the three cations under different experimental conditions. (auth)

21880 DETERMINATION OF FLUORIDE IN WATER SAMPLES BY SUBSTOICHIOMETRIC EXTRACTION WITH TRIMETHYLCHLOROSILANE. Das, H. A.; Koehnemann, W. H.; Wals, G. D.; Zonderhuis, J. (Reactor Centrum Nederland, Petten). J. Radioanal. Chem.; 25: No. 2, 261-267(1975).

The determination of fluoride in aqueous solutions by substoichiometric extraction was performed using a carrier-free spike of ^{18}F (T = 110 m). The principle, the procedure, and the results of tap water and urine analysis are given. (auth)

21881 NILE BLUE AS A REDOX INDICATOR IN CERATE OXIDIMETRY. Venkateswara Rao, N.; Avadhanulu, A. B.; Sri Krishna, K. (Andhra Univ., Waltair, India). Indian J. Chem.; 13: No. 3, 283-284(Mar 1975).

The use of Nile Blue (Color Index No. 51180) as redox indicator in the titration of iron(II), hexacyanoferrate(II), arsenic(III), vanadium(IV), uranium(IV), molybdenum(V), and hydroquinone with ammonium hexanitratocerate(IV) in perchloric acid medium is reported. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 22350 and 22373.

21882 OXYGEN BOMB COMBUSTION OF ENVIRONMENTAL AND BIOLOGICAL SAMPLES FOR TRITIUM ANALYSIS. Moghissi, A. A.; Bretthauer, E. W.; Whittaker, E. L.; McNelis, D. N. (National Environmental Research Centre, Las Vegas, NV). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 339-342(Jun 1975).

An oxygen bomb is described, which is capable of combusting up to 10 g of environmental and biological samples. Water recovery exceeds 98% with a memory effect for tritium of generally less than 2% of the amount of tritium in previous sample. The method is used for the assay of tritium but can easily be adapted for ^{14}C, ^{35}S, and other radionuclides. (auth)

21883 NEW METHOD FOR DETERMINATION OF Sr-89, Sr-90, AND 90-Y IN AQUEOUS SOLUTION WITH THE AID OF LIQUID SCINTILLATION COUNTING. Buchtela, K.; Tschurlovits, M. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 333-338(Jun 1975). (In German).

A method for determination of ^{89}Sr, ^{90}Sr and ^{90}Y is described. The Sr-sample is measured in a liquid scintillation counter in aqueous solution. From the results of three measurements (scintillation counting, Cherenkov counting and Cherenkov counting with wave-length shifter) the activity of the three radionuclides in the sample can be determined. (auth)

21884 METHODS OF ANALYSIS OF RADIOACTIVE MATERIAL SEPARATED INTO SOLID AND LIQUID PHASES. Glover, J. S.; Shepherd, B. P. (to Radiochemical Centre Ltd.). US Patent 3,883,738. 13 May 1975. Priority date 16 Dec 1971, United Kingdom of Great Britain and Northern Ireland. 6p.

In analyses, particularly competitive assays, in which a radioactive element is partitioned between the two phases, the level of activity of one phase is measured while the two phases are in contact in the same vessel. This is achieved by using a specially shaped vessel and/or by accurately collimating the counter and screening it from part of the contents of the vessel. (auth)

21885 LIQUID SCINTILLATION COUNTING OF COBALT-57: APPLICATION TO RADIO-ASSAY OF VITAMIN B_{12} [CYANOCOBALAMIN]. Gutcho, S.; Johnson, J.; McCarter, H. (Becton, Dickson, and Co., Orangeburg, NY). Clin. Chem.; 19: No. 9, 998-1001(1973).

Serum plus [^{57}Co]cyanocobalamin is treated as described by Lau et al. (Blood, 26: 202(1965), 28: 130(1966)) for the determination of the vitamin by a protein-binding method; uncoated charcoal is used to separate the free and bound forms of the vitamin, and the binding protein is intrinsic factor. The supernatant solution containing the bound ^{57}Co is counted in a liquid scintillation system containing Unogel (Schwarz/Mann) for up to 10 min. The counting efficiency at 122 keV is 62 percent and the calibration graph (cpm vs concentration of vitamin) is rectilinear, with a slope of -2.56 and an intercept on the ordinate of 6.19. (Anal. Abstr.)

21886 AUTOMATIC LIQUID SCINTILLATION COUNTING OF ^{32}P IN PLANT EXTRACTS BY MEASURING THE CERENKOV

RADIATION IN AQUEOUS SOLUTIONS. Fric, F.; Palovcikova, V. (Slovenska Akademia Vied, Bratislava). Int. J. Appl. Radiat. Isot.; 26: No. 5, 305-311(May 1975).

Automatic liquid scintillation counting of ^{32}P activity by means of Cherenkov radiation in plant extracts, solubilized plant material, or solubilized polyacrylamide gels is described. For quench correction, the isotope channels ratio method was found to be satisfactory. (auth)

21887 METHOD FOR THE DETERMINATION OF ^{90}Sr USING Al AS CARRIER FOR ^{90}Y. Brnovic, R. Naucno-Teh. Pregl.; 21: No. 8, 33-38(1971). (In Slovak).

The application of this method was tested on a large number of samples from the biosphere (milk, food, soil, water, and bones). The efficiency of the separation of ^{90}Y on aluminum hydroxide is about 95% and is totally selective with respect to the known half life of ^{90}Y (64 hrs). (Bull. Sci., Sect. A)

21888 LIQUID SCINTILLATION COUNTING IN HIGH-DENSITY POLYETHYLENE VIALS. Horrocks, D. L. (Beckman Instruments, Inc., Fullerton, CA). Int. J. Appl. Radiat. Isot.; 26: No. 5, 243-256(May 1975).

It has been shown previously that both scintillation solvents and solutes diffuse into the walls of high-density polyethylene vials. This diffusion causes the plastic vial walls to act as a plastic scintillator, which has a much lower scintillation efficiency than the solution itself. The result is the observation of a time dependence of the external standard channels ratio (ESCR) value. The absolute change of the ESCR value and its rate of change is dependent on the choice of the external standard counting channels. It is shown that with the proper choice of the external standard counting channels, the time change of the ESCR value can be essentially eliminated for up to a 3-day time period. The diffusion process has also been shown to cause an increase in the measured background rate mainly in the tritium counting channel (i.e., low-amplitude pulses). The counting efficiency was unchanged over extended time periods (up to 12 days) even though appreciable amounts of the samples may also diffuse through the vial walls. (auth)

21889 X-RAY FLUORESCENCE ANALYSIS OF WHOLE COAL. Kuhn, J. K.; Harfst, W. F.; Shimp, N. F. (Illinois State Geological Survey, Urbana). pp 66-73 of Trace Elements in Fuel. Babu, S. P. (ed.). Washington, DC; American Chemical Society (1975).

X-ray fluorescence analysis proved to be rapid, simple, and reasonably accurate for determining the concentration of 21 minor and trace elements in whole coal. Development of the method was facilitated by the availability of a set of samples analyzed during the investigation of over 100 coals for trace and minor elements by optical emission spectroscopy, atomic absorption spectroscopy, neutron activation, and wet chemical techniques. Although major elements in coal, carbon, hydrogen, oxygen, and nitrogen, cannot be analyzed by x-ray fluorescence, most other elements at levels greater than a few parts per million are readily determined. Tables present data supporting the conclusion that x-ray fluorescence may be the best method for analyzing large numbers of coal samples. (auth)

21890 ACCURATE AND SIMPLE MEASUREMENT METHOD OF COMPLEX DECAY SCHEMES OF RADIONUCLIDE ACTIVITY. Legrand, J.; Clement, C.; Bac, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Lab. de Metrologie des Rayonnements Ionisants). Bull. Inf. Bur. Natl. Metrol.; 6: No. 19, 31-35(Jan 1975). (In French).

A simple method for the measurement of the activity is described. It consists of using a well-type sodium iodide crystal whose efficiency with monoenergetic photon rays has been computed or measured. For each radionuclide with a complex decay scheme a total efficiency is computed; it is shown that the efficiency is very high, near 100%. The associated incertainty is low, in spite of the important uncertainties on the different parameters used in the computation. The method has been applied to the measurement of the ^{152}Eu primary reference. (FR)

21891 X-RAY-FLUORESCENCE ANALYSIS OF Sr-Ca-Bi TITANATE. Bondarenko, S. K.; Kislov, B. I. (All-Union Scientific-Research Inst. of Chemical Pure Materials for Electronic Engineering, Donetsk, USSR). Zh. Anal. Khim.; 30: No. 6, 1179-1182(Jun 1975). (In Russian).

The method of full factor experiment was used to study the effect of the degree of dilution of the sample with the plastic "Stan-2" and addition of lanthanum oxide on the mutual effect of elements in the x-ray fluorescence analysis of materials of the system of Sr-Ca-Bi titanates. Conditions have been found for the analysis by the external standard method. The relative standard deviations of determining the components by the external standard method equal 0.6, 1.6, 1.3, and 0.4% for Sr, Ca, Bi, and Ti oxides respectively. (auth)

21892 SUBSTOICHIOMETRIC PRECIPITATION OF IODINE MICROAMOUNTS IN THE METHOD OF RADIOMETRIC CORRECTION. Golubtsov, I. V.; Ignatov, V. P. (Moscow State Univ.). Zh. Anal. Khim.; 30: No. 6, 1170-1173(Jun 1975). (In Russian).

In the determination of iodine microamounts by substoichiometric precipitation with Ag (the method of radiometric correction), dialysis and electrodialysis were used to separate the colloid-disperse phase of AgI from the iodide left in the solution. The suggested procedure with the use of semi-permeable membranes permits determination of 5×10^{-7} to 1×10^{-4} g of iodine. (auth)

21893 SCANNING PROTON-INDUCED X-RAY MICROSPECTROMETRY IN AN ATMOSPHERIC ENVIRONMENT. Horowitz, P. (Harvard Univ., Cambridge, MA); Grodzins, L. Science; 189: No. 4205, 795-797(5 Sep 1975).

Collimated million-electron-volt proton beams, brought out into air, can be used as a scanning microprobe to examine specimens with a spatial resolution of the order of 1 micrometer. Trace elements at concentrations as low as 1 part per million can be detected. Some preliminary results based on the use of this simple method are presented. (auth)

21894 SEMI-QUANTITATIVE DETERMINATION OF URANIUM, PLUTONIUM, AND AMERICIUM IN SEA WATER. Hodge, V. F.; Gurney, M. E. (Scripps Inst. of Oceanography, La Jolla, CA). Anal. Chem.; 47: No. 11, 1866-1868(Sep 1975).

A method was developed for surveying liter-sized volumes of seawater semiquantitatively for U, Pu, and Am. These elements are precipitated with small amounts of NaOH, electroplated directly from the dissolved precipitate onto counting discs, followed by high-resolution alpha counting. (JGB)

Separation Procedures

Refer also to abstract 23066.

21895 (BM-RI-7990) RECOVERY AND SEPARATION OF RARE-EARTH ELEMENTS, BARIUM, AND STRONTIUM FROM BASTNAESITE WITH SULFURIC ACID. Eisele, J. A.; Bauer, D. J. (Bureau of Mines, Reno, Nev. (USA). Reno Metallurgy Research Center). 1974. 13p. Dep. NTIS $4.00.

A bench-scale investigation was made of a concentrated H_2SO_4 reaction for recovering and separating rare earth elements, barium, and strontium from a bastnaesite ore and byproduct. Barium and strontium were dissolved in the concentrated acid and precipitated as a mixed product by water dilution. Separation of strontium from barium was effected by reaction with Na_2CO_3 solution, followed by a dilute acid leach of the $SrCO_3$ formed. After removing the barium and strontium from bastnaesite ore, the rare-earth elements were roasted to water-soluble sulfates. The rare earth sulfate solution was subsequently processed by solvent extraction to produce rare-earth oxides low in lead and magnesium. (auth)

21896 (BNWL-B-55) QUARTERLY TECHNICAL PROGRESS REPORT ON ARPA PROMPT FISSION YIELD PROJECT WORK FOR THE PERIOD 1 NOVEMBER 1970-31 JANUARY 1971. Ballou, N. E.; Kaye, J. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 31 Jan 1971. Contract AT(45-1)-1830. 12p. Dep. NTIS $4.00.

Equipment for sensing a rabbit capsule and for fast radiochemical separation of Br, Kr, and Se are described. The computer program GASPAN for gamma spectra analysis is also described briefly. Preliminary radionuclide measurements in the first test of the modified separation apparatus are given. (DLC)

21897 (NP-20507, pp 14-16) ADSORPTION OF Cs, Ba, AND Eu IONS ON ION EXCHANGE PAPER AND SURFACE ION EXCHANGERS. Seyb, K. E. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21898 (NP-20507, pp 17-20) RAPID LIQUID CHROMATOGRAPHY WITH THE CARRIER MATERIAL ZIPAX. Schaedel, M. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21899 (NP-20507, pp 21-25) GAS-JET TRANSPORT SYSTEM FOR FISSION PRODUCTS AND STUDY ON COUPLING IT TO CHEMICAL SEPARATION METHODS. Stender, E. (Univ., Mainz); Trautmann, N.; Silva, R. J. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21900 (NP-20507, pp 25-28) COUPLING OF A GAS JET TO THE SISAK SYSTEM FOR CONTINUOUS SEPARATION OF SHORT-LIVED FISSION PRODUCTS. Trautmann, N. (Univ., Mainz);

Stender, E.; Kaffrell, N.; Aronsson, P. O.; Skarnemark, G.; Bjoernstad, T.; Kvale, E.; Skarestad, M. Jun 1975. (In German). In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21901 (NP-20507, pp 29-35) THERMOCHROMATOGRAPHIC SEPARATION OF FISSION PRODUCTS. Zendel, M. (Univ., Mainz); Silva, R. J.; Trautmann, N. Jun 1975. (In German). In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21902 (NP-20507, pp 35-37) EVAPORATION OF FISSION PRODUCTS FROM LiF-UF_4 MELTS IN A GAS CURRENT. Weber, M.; Menke, H.; Trautmann, N. Jun 1975. (In German). In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21903 (NP-20507, pp 37-41) EVAPORATION OF FISSION PRODUCTS FROM LiF-UF_4 MELTS IN A VACUUM. Steiner, J. Jun 1975. (In German). In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21904 (NP-20507, pp 41-44) DEVELOPMENT OF A CHEMICAL SEPARATION APPARATUS FOR COMPLETELY AUTOMATIC CYCLIC OPERATION. Braun, H. Jun 1975. (In German). In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21905 (NP-20507, pp 100-102) STUDY OF SHORT-LIVED LANTHANUM, CERIUM, AND PRASEODYMIUM ISOTOPES WITH THE HELP OF THE SISAK TECHNIQUE. Kaffrell, N. (Univ., Mainz); Trautmann, N.; Aronsson, P. O.; Skarnemark, G.; Kvale, E.; Skarestad, M. Jun 1975. (In German). In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

21906 EXTRACTION OF LANTHANIDES WITH MIXTURES OF THENOYL-TRIFLUOROACETONE AND 2-METHYLPYRIDINE. Kuznik, B. (Politechnika Lodzka (Poland)); Genov, L.; Georgiev, G. (Chemisch-Technologisches Institut, Sofia (Bulgarien). Abt. fuer Anorganische Chemie). Monatsh. Chem.; 105: No. 6, 1190-1198(Nov 1974). (In German).

The extraction of some lanthanides from an aqueous phase with ionic strength of $\mu = 0.05$ by a mixture of thenoyltrifluoroacetone (TTA) and 2-methylpyridine (α'-picoline) in CCl_4 was investigated. The possibility of the formation of mixed tetra-β-diketonate complexes was shown and no difference was observed in the behavior of the lanthanides of the two sub-groups. (auth)

21907 EXTRACTION OF METAL IONS BY SULFOXIDES. III. Solvation of Metal Species by Dicyclohexylsulfoxide and Thioxanthene-10-oxide: Comparison of the Solvation and Extraction Properties of Sulfoxides of Varying Structure. Markl, P.; Jettmar, A. A. (Analytischen Institut der Universitat, Vienna). Mikrochim. Acta; 2: No. 1, 109-123(Jul 1975). (In German).

A report is given of the possibilities of extractive and extraction-chromatographic separations, that result from the differing solvation of metal species by dicyclohexylsulfoxide and thioxanthene-10-oxide. The R_f-spectra were determined by means of paper chromatography with inverted phases of 50 ions in dicyclohexylsulfoxide–HNO_3 system, of 19 ions in thioxanthene-10-oxide–HNO_3 system, of 31 ions in dicyclohexylsulfoxide–HCl system, as well as of 34 ions in thioxanthenesulfoxide–HCl system. On the basis of the R_f-spectra of selected metals, the solvation properties of dibenzylsulfoxide, diphenylsulfoxide, dicyclohexylsulfoxide, and thioxanthene-10-oxide were compared along with the selectivity of these compounds for certain separations. The relative extraction abilities of these sulfoxides as well as that of di-n-hexylsulfoxide were studied with regard to the extraction of uranyl nitrate, palladium(II)nitrate, and nitric acid. (auth)

21908 EMPLOYMENT OF CELLULOSE PRESSURE COLUMNS FOR THE CHROMATOGRAPHIC SEPARATION OF RADIOACTIVE NUCLIDES. I. Meier, H.; Zimmerhackl, E.; Unger, E.; Zeitler, G.; Albrecht, W.; Boesche, D.; Hecker, W.; Menge, P. (Staatliches Forschungsinstitut fuer Geochemic, Bamberg, Ger.). Mikrochim. Acta; 2: No. 1, 17-29(Jul 1975). (In German).

A study was made of the separation properties of cellulose pressure columns operating at a slight over-pressure of around 1 atmosphere, with respect to the length of the column packing, the flow rate, and the load. The optimal separation stage heights of the columns are situated at H = 0.16 mm. Since as a consequence of the favorable separation stage heights observed at column lengths of 3 to 6 cm, separation stage numbers of 200 to 400 are attained, and hence it is possible to attain separations within several minutes with flow rates of 1 ml/min. The choice of the mobile phase is made easier by the fact that paper chromatographic R_f-values can be transferred to the cellulose pressure column with the aid of a transfer function. (auth)

21909 ADSORPTION CHARACTERISTICS OF CARBONS OBTAINED FROM POLYVINYL CHLORIDE. Bansal, R. C.; Bhardwaj, S. S.; Mahajan, D. K.; Puri, B. R. (Panjab Univ., Chandigarh, India). Indian J. Chem.; 13: No. 2, 140-143(Feb 1975).

Adsorption studies on PVC carbons prepared by carbonization in (i) vacuum, (ii) nitrogen and (iii) carbon dioxide atmosphere are reported. In the last mentioned case, the product gets associated with nearly 2.7% (by weight) of oxygen. Adsorption isotherms of carbon dioxide (0°C) show a knee in the 90-150 mm pressure range, corresponding to adsorption of merely 1.4-1.7 cm^3. (NTP)/g of the gas. The Dubinin plots are linear, indicating surface area of 62, 51 and 129 m^2/g. for the three varieties of the carbons, respectively. Adsorption isotherms of water are of the type-III indicating low heat of adsorption and low porosity of the adsorbent. The pore volume, as calculated from the respective isotherm, comes out to be 0.032, 0.032 and 0.050 ml/g, for the three samples respectively. Adsorbability of benzene is almost negligible even at a pressure close to saturation pressure. The carbon is susceptible to chemisorption of oxygen on various oxidation treatments, resulting in the formation of acidic as well as non-acidic CO_2-complex, the relative proportions varying with the nature of the oxidation treatment. The CO-complex is formed to a much smaller extent in most cases. The presence of chemisorbed oxygen renders the surface hydrophilic, shifting the isotherm bodily upward. The carbon takes up appreciable amounts of iodine from solution in water, benzene and chloroform (the value is maximum from solution in chloroform) by physical adsorption as well as chemisorption. The chemisorption appears to occur at the unsaturated sites. (auth)

21910 SEPARATION OF Pa(V) FROM OTHER ELEMENTS BY SOLVENT EXTRACTION FROM THIOCYANATE SOLUTIONS. Nekrasova, V. V.; Pal'shin, E. S.; Myasoedov, B. F. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Anal. Khim.; 30: No. 6, 1122-1126(Jun 1975). (In Russian).

The extraction of Pa(V) and some other elements with trioctylamine in o-xylene solutions from thiocyanate solutions has been studied as a function of both thiocyanate and hydrogen ion concentrations and of other factors. A procedure is suggested of separation of Pa from U by using thiocyanate solutions and of separation of Pa from irradiated Th and other complex materials by trioctylamine extraction. (auth)

21911 SOLVENT EXTRACTION OF TRIVALENT TRANSPLUTONIUM ELEMENTS AND Eu WITH ALKYLENEDIPHOSPHINE DIOXIDES FROM NITRIC ACID SOLUTION. Chmutova, M. K.; Nesterova, N. P.; Koiro, O. E.; Myasoedov, B. F. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Anal. Khim.; 30: No. 6, 1110-1115(Jun 1975). (In Russian).

The solvent extraction of trivalent Am, Cm, Bk, Cf, and Eu with five different tetraarylalkylenediphosphine dioxides was examined from 0.5 to 15.7 M HNO_3 solutions. The previously reported regularities of changing the extraction power of the reagents of this group with their structure describe only the extraction from relatively weakly acid media but not that from strongly acid media. The separation factors for all the reagents studied depend on HNO_3 concentration. They are very small in the extraction from 0.5 to 4.0 M HNO_3 and reach the maximum values at HNO_3 concentration of 15.7 M. The reagent selectivity and the order of the extraction of the elements depend mainly on the structure of the bridge between the P = O groups. (auth)

21912 CHROMATOGRAPHIC SEPARATION OF CURIUM, AMERICIUM, AND THE LANTHANIDES WITH THE AID OF ORGANOPHOSPHORUS COMPLEXONES. Chuveleva, E. A.; Kharitnov, O. V.; Gelis, V. M.; Nazarov, P. P.; Chmutov, K. V. (Inst. of Physical Chemistry, Moscow). Russ. J. Phys. Chem.; 48: No. 11, 1673-1675(Nov 1974).

Translated from Zh. Fiz. Khim.; 48: No. 11, 2846-2848(Nov 1974).

Microamounts of curium, americium, and the lanthanides were separated chromatographically with the aid of organophosphorus complexones at room temperature and 70°C. The separation factors and the height equivalent to the theoretical plate (HETP) were determined. (auth)

21913 EXTRACTION OF ALKALI METAL HALIDES. Kuznetsova, E. M.; Ushakova, T. V.; Sud'ina, G. F. Russ. J. Phys. Chem.; 48: No. 11, 1590-1591(Nov 1974).

Translated from Zh. Fiz. Khim.; 48: No. 11, 2690-2692(Nov 1974).

The applicability of the equation derived previously for the theoretical description of the extraction of alkali metal halides by alcohols was tested. The theoretical partition coefficients of LiCl, LiBr, LiI, NaCl, KCl, CsCl, and CsI in their extraction from

water in butyl, isobutyl, pentyl, and isopentyl alcohols are in satisfactory agreement with the experimental and literature values. (auth)

21914 ION EXCHANGE SEPARATION OF SCANDIUM FROM ACCOMPANYING ELEMENTS. Kudryavskii, Yu. P.; Kazantsev, E. I.; Kazantsev, E. A.; Baryshnikov, A. S.; Onosov, V. N. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vysah. Ucheb. Zaved., Tsvet. Met.; No. 2, 88-90(1975). (In Russian).

The behavior of scandium and accompanying elements was studied on the macroporous phosphoric acid cation exchange resin KFP-8. Scandium sorption was considerably greater than that of the accompanying di- and tri-valent elements. Scandium apparently forms such a strong bond with the ionogenic groups of the resin that it is not destroyed when the resin is washed with sulfuric, hydrochloric, or nitric acid. Hydrofluoric acid or alkali fluoride solution is necessary for desorption. Because of the differences in the ion exchange behavior, scandium can be separated from 5- to 100-fold amounts of Y, La, Al, Fe(III), Ca, or Mn. (TTT)

21915 SEPARATION OF RARE EARTHS USING FRONTAL EXTRACTION CHROMATOGRAPHY. Vassilev, H.; Faitondjiev, L. P.; Havezov, I. P. (Chemisch-Technologische Hochschule, Sofia). Compt. Rend. Acad. Bulg. Sci.; 28: No. 2, 193-196(1975). (In German).

The suitability of frontal extraction chromatography for the separation of rare earths was tested using bis(2-ethylhexyl) phosphate as the stationary phase and hydrochloric acid solutions of Ce and Nd as the mobile phase. The effect of the HCl concentration on the capacity of the column was determined. The results are graphed and show that a higher Ce enrichment is found in the filtrate when the initial HCl concentration is lower. However a comparison of the separation obtained by frontal chromatography with the separation obtained by elution chromatography indicates the much greater separation obtained with the latter method. (JSR)

21916 CO-EXTRACTION OF TECHNETIUM WITH URANYL NITRATE TRIBUTYLPHOSPHATE COMPLEX. Macasek, F. (Comenius Univ., Bratislava). Radiochem. Radioanal. Lett.; 22: No. 3, 175-183(15 Aug 1975).

Uranium enhances the extraction of pertechnetate with TBP/CCl_4 solutions which has been explained by the formation of a mixed pertechnetato-nitrato complex of uranyl. An equilibrium constant of the heterogeneous exchange reaction was established in the system 4 M NH_4NO_3–1 M TBP. (auth)

21917 EXTRACTIONS WITH METAL-DITHIOCARBAMATES AS REAGENTS (INCLUDING Hg, Ag, Bi, Cu, Cd, In, Sb, Zn, Te, Co, As, AND Fe). Wyttenbach, A.; Bajo, S. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). Anal. Chem.; 47: No. 11, 1813-1817(Sep 1975).

The metal–dithiocarbamates Hd$(DDC)_2$, Ag(DDC), Ni$(DDC)_2$, Cu$(DDC)_2$, Sb$(DDC)_3$, Te$(DDC)_4$, Se$(DDC)_3$, In$(DDC)_3$, As$(DDC)_3$, Cd$(DDC)_2$, Zn$(DDC)_2$, Co$(DDC)_3$, Fe$(DDC)_3$, and Tl(DDC) were tested as reagents for the extraction of 12 different metals (including Hg, Ag, Bi, Cu, Cd, In, Sb, Zn, Te, Co, As, and Fe) from 0.1N H_2SO_4 and from solutions of pH 5 into $CHCl_3$. These reagents show excellent selectivity for the extraction of metals with higher conditional extraction constants. In the majority of all cases, extraction is complete within 2 minutes; Se$(DDC)_4$, Co$(DDC)_3$, and Fe$(DDC)_3$, however, react only slowly and in some cases incompletely or not at all. The successive extraction of a sample with several different reagents yields a series of organic fractions that contain different metals. As an example, the application of these reagents to a neutron activated biological sample is given, where the resulting organic fractions can be directly submitted to gamma-spectrometry without any further chemical treatment. (auth)

21918 FIXATION OF RADIOACTIVE ELEMENTS ON DEXTRAN GEL SEPHADEX. Hafez, M. B.; Saied, F. A. I. (Atomic Energy Establishment, Cairo). J. Radioanal. Chem.; 25: No. 2, 225-260(1975).

Studies are reported to illustrate surface adsorption of ^{144}Ce, ^{59}Fe, ^{234}Th, ^{233}U, ^{237}Np, ^{239}Pu and ^{241}Am on a dextran gel made by crosslinkage of the polysaccharide dextran (Sephadex). Fixation of such elements was studied from aqueous solution and was found to depend on pH, age of the tracer solution, hydrolytic behavior of the adsorbed species, concentration, and the valency of the adsorbed element. (auth)

21919 RETENTION OF ^{85}Sr AND ^{147}Pm ON INSOLUBLE HYDROXIDES AND PHOSPHATES PREPARED BY THE SOL–GEL PROCEDURE. Kepak, F.; Caletka, R.; Nova, I. (Inst. of Nuclear Research, Rez, Czech.). J. Radioanal. Chem.; 25: No. 2, 247-254(1975).

Retention of strontium and promethium on hydroxides (hydrated oxides) and phosphates of iron and chromium prepared by the sol-gel method was studied. The sorption was determined under static conditions depending on the pH of the solution. The sorption isotherms and retention were investigated under dynamic conditions. (auth)

21920 APPLICATION OF COPPER(II)-DI-(ETHYLHEXYL)-PHOSPHATE FOR CATION-EXCHANGE EXTRACTION FROM MOLTEN NITRATE SALT. Mitsugashira, T.; Yamamura, Y.; Suzuki, S. (Tohoku Univ., Sendai). Radiochem. Radioanal. Lett.; 22: No. 2, 111-117(16 Jul 1975).

The H^+-problem, which was pointed out by Foos and Guillaumont on the extraction system between the molten nitrate salt and the chelate or cation-exchange extractant, can be overcome by the use of its metal-salt form as the extractant. And the copper(II)-di-(2-ethylhexyl)-phosphate is effective as the extractant from the molten nitrate mixture. A possible cation-exchange reaction is proposed to explain the above extraction. (auth)

Inorganic, Organic, and Physical Chemistry

Refer also to abstract 22015.

Chemical and Physicochemical Properties

Refer also to abstract 22827.

21921 (AERE-M–2635) DISTRIBUTION OF HNO_3 AT LOW CONCENTRATIONS BETWEEN H_2O AND TBP/OK. Miles, J. H.; Sharpe, B. P. K. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1975. 19p. Dep. NTIS (US Sales Only) $4.00. UK £1.00.

The distribution of HNO_3 between H_2O and 20^v/o or 30^v/o TBP/OK phases (tributyl phosphate/odorless kerosene) was studied with particular reference to the values for aqueous phases 0.1, 0.3, and 0.5 mol dm^{-3}. The curve obtained for 20^v/o TBP/OK at 25°C agrees well with thermodynamics predictions. It was obtained with a pure OK sample, and values derived from it are tabulated separately. All the other results are derived by making small corrections to data obtained using 21.6^v/o TBP/OK and 31.4^v/o TBP/OK and are slightly less accurate. Solution of the experimental problems in titrating organic phases of low acid content is described. (auth)

21922 (ANCR-1217) EXPLOSIVE HAZARDS ANALYSIS OF THE EUTECTIC SOLUTION NaK AND KO_2. Commander, J. C. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Jun 1975. Contract AT(10-1)-1375. 43p. Dep. NTIS $4.00.

Planning, preparation, conductance, and evaluation of field tests are reported to determine the explosive hazards associated with the combining of the sodium-potassium eutectic alloy (NaK) with the superoxide of potassium (KO_2) under various conditions of state, contamination, and detonation initiation. The planning and preparation was conducted by Aerojet Nuclear Company (ANC) at the Idaho National Engineering Laboratory, and the explosive hazards testing was done by Cook Associates, Inc., at IRECO Chemicals Pelican Point Research and Development facility in Utah. The test results showed that binary combinations of pure NaK and KO_2 could not be made to detonate, although the mixtures will spontaneously ignite and burn. However, tertiary combinations of NaK, KO_2 plus a water or hydrocarbon contaminate produced explosive hazards under a variety of conditions. The work was performed as part of the Decontamination and Decommissioning (D and D) of the first Experimental Breeder Reactor (EBR-1) and was funded by 189c I-215. (auth)

21923 (COO-3221-31) ONE ELECTRON-TRANSFER REDOX POTENTIALS OF FREE RADICALS. Progress report, September 1, 1974–July 1, 1975. Meisel, D.; Czapski, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1975. Contract AT(11-1)-3221. 20p. Dep. NTIS $4.00.

An attempt was made to calculate one electron redox potentials for some free radicals from data available in the literature. Previous redox potentials presented in the literature are entirely incorrect and the correct method for such calculations is outlined. Among other radicals, we find that the redox potential of the O_2/O_2^- system is -0.14 V at pH equals 7, and 0.15 V at pH equals 0. (auth)

21924 (UCID-16834) LITHIUM "SUPER HYDRIDE". Leider, H. R.; Lakner, J. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Jul 1975. Contract W-7405-Eng-48. 14p. Dep. NTIS $4.00.

Experiments at Lawrence Livermore Laboratory attempting to produce LiH/sub (1+X) are discussed. Since none of the attempts gave any convincing evidence of its existence, the experimental survey was terminated. (CK)

21925 ACID PROPERTIES OF THE OXYTETRAFLUORIDES OF MOLYBDENUM, TUNGSTEN, AND URANIUM TOWARD SOME INORGANIC FLUORIDE ION DONORS. Bougon, R.; Huy, T. B.; Charpin, P. (CEN de Saclay, Gif-sur-Yvette, France). Inorg. Chem.; 14: No. 8, 1822-1830(Aug 1975).

The behavior of $MoOF_4$, WOF_4, and UOF_4 was studied in the presence of ion donors of various strength: FNO, $ClOF_3$, ClF_3, ClF_5, and HF. For both $MoOF_4$ and WOF_4 in HF solutions, evidence for a partial ionization into Mo_2O_2F/sub 9-/ and W_2O_2F/sub 9-/ was found. From the equilibrium constant values, WOF_4 was found to be a stronger Lewis acid than $MoOF_4$, whereas no direct comparison with the strength of UOF_4 is possible because of its quasi-insolubility in HF. Lewis acid properties of the oxytetrafluorides studied are also demonstrated by the ionic structures found for the adducts with the strong bases FNO and $ClOF_3$. The new adducts $NOMo_2O_2F_9$, $NOW_2O_2F_9$, $ClOF_2Mo_2O_2F_9$, $ClOF_2MoOF_5$, $(NO)_2MoOF_6$, and $(NO)_2WOF_6$ were prepared. Their vibrational spectra and, for some of them, x-ray powder diffraction patterns are given. The unit cell parameters of the adducts $NOMoOF_5$, $NOWOF_5$, and $(NO)_2WOF_6$ were determined. A study of the HF solutions of the nitrosyl salts was made by Raman and ^{19}F NMR spectroscopy. This, together with data on propylene carbonate solutions of the same adducts, allowed the identification of the species in the oxytetrafluoride–FNO–HF system. Depending on the F^- concentration the anions M_2O_2F/sub 9-/, MOF/sub 5-/, and MOF_6^{2-} (M equals Mo or W) are formed, which are in equilibrium with the solvent. The mechanisms of these equilibria are proposed. The results obtained with the F^- donor fluorinating agents indicate that ionic intermediary steps occur in the fluorination process of the oxytetrafluorides to the corresponding hexafluorides. (auth)

21926 INTERACTION OF URANYL ACETATE WITH DNA. Drynov, I. D.; Poletaev, A. I.; Kharitonenkov, I. G.; Klimenko, S. M. (Inst. of Virology, Moscow). Mol. Biol.; 8: No. 1, 27-33 (1974).

Translated from Mol. Biol. (Moscow); 8: No. 1, 35-42(1974).

The state of DNA in a complex with a uranyl (U) ion was investigated. The formation of a DNA-U complex is accompanied by changes in the absorption and circular dichroism spectra, a change in viscosity, and an increase in the rate of the reaction of DNA with formaldehyde. A study of the melting point showed that setting U on DNA leads to local destabilization and destruction of its secondary structure, which is confirmed by the presence of an "early" stage in the reaction with formaldehyde and a decrease in the viscosity of the solutions. It is shown that the interaction of U ions with DNA is of a cooperative nature. A study of the circular dichroism of the complex confirmed the previous conclusions, while the use of the competitive reaction method made it possible to determine the dissociation constant of the DNA-U complex: $1.2 \cdot 10^{21}$ $mole^{-1}$. (auth)

21927 CATALYST FOR HYDROCARBON CONVERSION. Duhaut, P.; Miquel, J. (to Societe Francaise des Produits pour Catalyse). US Patent 3,898,178. 5 Aug 1975. Priority date 15 Dec 1971, France. 8p.

A description is given for a catalyst and process for hydrocarbon conversions, e.g., reforming. The catalyst contains an alumina carrier, platinum, iridium, at least one metal selected from uranium, vanadium, and gallium, and optionally halogen in the form of metal halide of one of the aforesaid components. (auth)

21928 INTERACTION OF LIQUID ALUMINUM WITH KCl–NaCl–$ThCl_4$ MELTS. Gazizov, R. K.; Lebedev, V. A.; Nichkov, I. F.; Poyarkov, A. M.; Raspopin, S. F. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 2, 144-146(1975). (In Russian).

Experiments carried out in purified argon showed that in the reaction of aluminum with the subject melt, part of the thorium is reduced: $3Th^{4+} + 4Al \rightleftharpoons 3Th_{Al} + 4Al^{3+}$. The degree of thorium reduction depends on the temperature and the thorium content of the electrolyte, reaching 46% at 820°C with 4 wt% $ThCl_4$ in the initial electrolyte. The thorium content in the melt (2.5 to 18.5 wt%) in the experiments did not exceed the solubility of thorium in aluminum at the temperature of the experiment. (TTT)

21929 COMPLEXES OF ORGANIC ARSONIC ACIDS WITH METAL IONS. III. Complexes of U(IV) With Phenylarsonic Acid and Its Ortho- and Para-Substituted Derivatives. Sandhu, S. S.; Aulakh, G. S. (Guru Nanak Univ., Amritsar, India). Indian J. Chem.; 13: No. 281-282(Mar 1975).

Phenylarsonic-, p-tolylarsonic-, p-methoxyphenylarsonic-, p-chlorophenylarsonic- and p-bromophenylarsonic acids (LH_2) yield complexes of the type $UL_2.XH_2O$ (where X is 0 or 2) with U(IV). However, with o-carboxyphenylarsonic acid ($L'H_2$) the complex $(UOH)_2L'.2H_2O$ was isolated. On the basis of their high melting points, insolubility in most of the organic solvents and reflectance spectra and temperature dependent magnetic susceptibilities, these complexes were assigned eight coordinated polymeric structures. (auth)

21930 STABILITIES OF Co(II), Ni(II), Cu(II), Zn(II), Cd(II), AND UO_2(II) COMPLEXES OF THE SCHIFF BASE DERIVED FROM BENZOYLACETONE AND ANTHRANILIC ACID. Pania, S. L.; Kaul, K. N.; Mehta, R. K. (Univ. of Jodhpur, India). Indian J. Chem.; 13: No. 3, 295-297(Mar 1975).

Dissociation constants of benzoylacetone-anthranilic acid (H_2BA) and the stability constants of its complexes with Co(II), Ni(II), Cu(II), Zn(II), Cd(II) and UO_2(II) were determined in water–dioxane medium (50:50) at 30 ± 0.1° following the Calvin–Bjerrum pH-titration technique as modified by Irving and Rossotti. The stability constants are in fair agreement with Irving–Williams rule. (auth)

Isotope Effects

Refer also to abstracts 22040 and 22863.

21931 HYDROGEN BONDING. V. Possible Existence of Strongly Hydrogen-Bonded Water--Fluoride and Water--Hydroxide Complex Anions, $(F^-.H_2O)_2^{2-}$ and $(OH^-.H_2O)_2^{2-}$, in Tetramethylammonium Ion Salt Hydrates. Harmon, K. M.; Gennick, I. (Oakland Univ., Rochester, MI). Inorg. Chem.; 14: No. 8, 1840-1845 (Aug 1975).

Tetramethylammonium fluoride and hydroxide form stable monohydrates from which water is removed only with difficulty at high temperatures with concurrent decomposition to trimethylamine. The infrared spectra of the monohydrates are completely different from those of the higher clathrate hydrates and show, in addition to cation bands and stretching and bending bands representative of strongly hydrogen-bonded O–H, two intense bands in the region assigned to rocking or torsional modes of tightly coordinated water (tricoordinated oxygen). Cation C–H to anion hydrogen bonding is present but is not strong enough to account for the third coordinate link to water. This fact, coupled with steric limitations on anion size and the appearance of the cation infrared spectra of the hydrates, suggests that discrete, probably dinegative, water-anion species exist in these salts. This is supported by symmetry coordinate analysis of the proposed molecular ions and by topological equivalent-orbital approach comparisons. Infrared spectral bands associated with the water–anion complex species in tetramethylammonium hydroxide and fluoride hydrates and their deuterated analogs are given. (auth)

21932 DENSITIES OF SOLUTIONS OF P-DIOXANE IN H_2O AND D_2O. Waters, P. F.; Jaffer, S. (American Univ., Washington, DC). J. Chem. Soc. (London), Chem. Commun.; No. 13, 529-531(2 Jul 1975).

Density-composition curves for p-dioxane-H_2O and p-dioxane-D_2O solutions indicate a different extent of interaction of p-dioxane with H_2O than with D_2O; i.r. results for the same systems confirm this. (auth)

21933 PHOTOCHROMISM OF QUINOLYLHYDRAZONES. III. The Mechanism of Isomerization of the Photocolored Alpha-Quinolylimino-(Z)-Hydrazone to the Alpha-Quinolylamino-(E)-Hydrazone. Wong, J. L.; Zady, M. F. (Univ. of Louisville, KY). J. Org. Chem.; 40: No. 17, 2512-2516(22 Aug 1975).

The kinetics and mechanism of the thermal decay of the photocolored form 1a of salicylaldehyde 2-quinolylhydrazone are reported. Two isomerization reactions, viz., alpha-amino- to alpha-aminoquinoline and Z yields E hydrazone, are involved. The first conversion occurs via an intramolecular transfer of the phenolic hydrogen to the alpha-imino group. This is deduced on the basis of medium effect, concentration effect, and base inhibition studies. The decay of the 8-nitro colored form confirms this and implicates the quinoline NH as the source of the phenolic hydrogen of the uncolored form. The overall deuterium isotope effect of 1.84 denotes the non-rate-determining nature of the participation of the OH and NH. Since plots of the logarithm of the decay rate constant k vs solvent Z or E/sub T/ values show linear relationship and large negative DELTA S values accompany the decay process, a rotation mechanism is postulated for the Z yields E hydrazone isomerization. Also, acid catalysis substantiates the mechanistic scheme proposed for the decay process. (auth)

21934 DEUTERIUM ISOTOPE EFFECTS IN THE IN VIVO METABOLISM OF COTININE. Dagne, E.; Gruenke, L.; Castagnoli, N. Jr. (Univ. of California, San Francisco). J. Med. Chem.; 17: No. 12, 1330-1333(Dec 1974).

In an attempt to further understanding of the molecular mechanisms associated with the mammalian oxidative metabolism of foreign substances, the deuterium isotope effect involved in the in vivo metabolism of the tobacco alkaloid cotinine was investigated. Mixtures of cotinine-d_0 and cotinine-3,3-d_2 in varying ratios were administered to Rhesus monkeys. Unchanged drug and several of its oxidized metabolites including trans-3-hydroxycotinine were isolated from the 24-hr urine collection. The deuterium contents of these isolated compounds were found to be greater than that present in the administered cotinine except for trans-3-hydroxycotinine which showed a substantial decrease in the deuterium to proton ratio. On the basis of these determinations the deuterium isotope effect for the 3-hydroxylation of cotinine was calculated to be between 6 and 7, indicating that carbon–hydrogen bond cleavage is likely to be involved in the rate-determining step in this metabolic conversion. (auth)

21935 TRITIUM NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. III. Coupling Constants and Isotope Effects, and Calculation of $^2J_{HH}$ Coupling Constants. Al-Rawi, J. M. A.; Elvidge, J. A.; Jones, J. R.; Evans, E. A. (Univ. of Surrey, Guildford, Eng.). J. Chem. Soc. (London), Perkin Trans., II.; No. 5, 449-452(1975).

J_{HT} Couplings are closely predictable from J_{HH} couplings and vice versa: a new set of $^2J_{HH}$ coupling constants has thus been derived, of higher precision than any previously calculated from $^2J_{HD}$ couplings. Primary isotope effects become noticeable for the larger $^1J_{CT}$ couplings. Various secondary isotope effects on chemical shifts were noted. (auth)

21936 ASSOCIATION AND STRUCTURE OF THE ION PAIRS OF LITHIUM AND SODIUM NITRATES IN WATER AND OF SODIUM NITRATE IN HEAVY WATER AT 25°C. Solovkin, A. S. Russ. J. Phys. Chem.; 48: No. 11, 1571-1573(Nov 1974).

Translated from Zh. Fiz. Khim.; 48: No. 11, 2655-2658(Nov 1974).

The literature data for the densities of lithium and sodium nitrate solutions in water and of sodium nitrate solutions in heavy water were analyzed on the basis of the model of ion hydration in aqueous solutions developed previously. It was found that the equilibrium constants for the reaction, $M^+(H_2O)_3(NO_3^-) \rightleftharpoons M^+(aq) + NO_3^-(aq)$ (M = Li, Na), are 43 and 7 in the case of lithium and sodium respectively. The equilibrium constant for the dissociation of the sodium salt in heavy water is 6.35. Over the entire experimental concentration range up to 7.8 M $LiNO_3$, only ion pairs separated by solvent species are formed in the lithium nitrate solutions, whereas $NaNO_3$ forms also contact ion pairs. A structure is proposed for the ion pairs. (auth)

21937 KINETIC ISOTOPE EFFECTS IN THE OXIDATION OF BENZHYDROL AND FLUOREN-9-OL BY Cr(VI): NATURE OF TRANSITION STATE. Sadagopa Ramanujam, V. M.; Venkatasubramanian, N. (Vivekananda Coll., Madras). Indian J. Chem.; 13: No. 3, 285-287(Mar 1975).

The temperature dependence of the kinetic isotope effect in the Cr(VI) oxidation of benzhydrol and fluoren-9-ol shows that the reaction proceeds through a cyclic concerted H-transfer in the transition state. Rate constants and Arrhenius paremeters for the deuterated and normal compounds are tabulated. (auth)

21938 KINETICS OF OXIDATION OF MANDELIC ACID BY N-BROMOSUCCINIMIDE. Natarajan, R.; Venkatasubramanian, N. (Vivekananda Coll., Madras). Indian J. Chem.; 13: No. 3, 261-263(Mar 1975).

Kinetics of the oxidation of mandelic acid by N-bromosuccinimide (NBS) in the presence of Hg(II) was investigated in binary solvent mixtures of acetic acid and water in the presence of sulfuric acid. Under these conditions the oxidation exhibits a total second order dependence; first order each with respect to mandelic acid and NBS. The oxidation products were identified as benzaldehyde and carbon dioxide. The pH dependence of the oxidation was analyzed. No direct correlation between the rate and dielectric constant of the solvent was observed. The reaction shows no kinetic isotope effect, α-deutero mandelic acid being oxidized at a rate almost identical with that of the parent compound. Based on these observations a mechanism was proposed for the oxidative decarboxylation of mandelic acid. (auth)

21939 NMR INVESTIGATION OF MOLECULAR MOTION, PREFERENTIAL SOLVATION AND HYDROGEN BONDING IN POLYMER SOLUTIONS. Rockelmann, H.; Sillescu, H. (Frankfurt Univ. (F. R. Germany). Inst. fuer Physikalische Chemie). Z. Phys. Chem. (Frankfurt); 92: 4-6, p. 263-280(Oct 1974).

6 figs.; 2 tabs.; 30 refs.

Deuteron relaxation times of $CDCl_3$ were measured in solutions of polyvinylpyrrolidone(PVP) and polystyrene(PS) in mixed solvents. The 2nd component was CCl_4, cy-C_6H_{12}, and n-C_7H_{16} for the PVP, and CH_3COCH_3 for the PS solutions. The deuteron relaxation time of the 2nd component was determined in the PVP/$CHCl_3$/cy-C_6D_{12} and PS/$CHCl_3$/CD_3COCD_3 solutions. Furthermore, the self diffusion coefficients of all protonated solvent components were measured by the spin echo method. The life time of the PVP-$CDCl_3$ hydrogen bond was estimated to approximately 10^{-10} sec and found not to change drastically on addition of the 2nd solvent component. Information on the segmental motion of PVP in solution was obtained from the proton relaxation times. (auth)

21940 HYDROXIDE ION CATALYZED REVERSE ALDOL-TYPE CONDENSATION REACTIONS OF PARA-SUBSTITUTED BENZOYLACETALDEHYDES. Fedor, L. R.; Murty, B. S. R.; De, N. C. (State Univ. of New York, Buffalo). J. Am. Chem. Soc.; 97: No. 15, 4308-4312(23 Jul 1975).

The apparent hydroxide ion catalyzed decomposition of para-substituted benzoylacetaldehydes to give para-substituted acetophenones and formate ions is characterized by rate saturation at high hydroxide ion concentrations (0.1–1 M); thus the order in hydroxide ion varies from 1 at low hydroxide ion concentrations to 0 at high hydroxide ion concentrations. These kinetics suggest that the critical transition state contains aldehyde hydrate monoanion and hydroxide ion or the kinetically equivalent aldehyde hydrate dianion in analogy to earlier work. A number of rate constants, including those for product-forming decomposition of aldehyde hydrate monoanion apparently catalyzed by hydroxide ion, were calculated from the experimental data and estimates of various equilibrium constants. For decomposition of aldehyde hydrate monoanions catalyzed by hydroxide ions, the calculated rho equals 1 and the deuterium solvent kinetic isotope effects k/sup D//k/sup H/ equals 1.1–1.5 suggest that heavy atom reorganization plays a major role in product formation. (auth)

21941 SECONDARY alpha-DEUTERIUM KINETIC ISOTOPE EFFECTS AND TRANSITION-STATE STRUCTURES FOR THE HYDROLYSIS AND HYDRAZINOLYSIS REACTIONS OF FORMATE ESTERS. Bilkadi, Z.; de Lorimier, R.; Kirsch, J. F. (Univ. of California, Berkeley). J. Am. Chem. Soc.; 97: No. 15, 4317-4322(23 Jul 1975).

The transition-state structures for several formyl transfer reactions from methyl formate have been examined by measuring the secondary alpha-deuterium kinetic isotope effects. The value of k/sub D//k/sub H/ for alkaline hydrolysis is 1.05 +- 0.01. This figure taken together with previously determined data on the methoxyl-O-18 kinetic isotope effect and a simple theoretical estimate of the important vibrational frequencies of the anionic tetrahedral intermediate leads to a moderately precise description of the bond orders in the transition state. These are 1.0, 1.54 +- 0.07, 0.98 +- 0.01, and 0.48 +- 0.07 for the C–H, carbonyl, acyl carbon-methoxyl oxygen, and acyl carbon-hydroxide oxygen bonds, respectively. The value of the alpha-deuterium kinetic isotope effect for the alkaline hydrolysis of ethyl formate is k/sub D//k/sub H/ equals 1.10 +- 0.01, implying a more nearly tetrahedral configuration in the transition state for that reaction of this ester. Other values of k/sub D//k/sub H/ are 1.23 +- 0.02 for acid hydrolysis of methyl formate, 1.23 +- 0.01 for acid hydrolysis of ethyl formate, 1.38 +- 0.01 for rate-determining formation of the anionic tetrahedral intermediate (T^-) in the hydrazinolysis reaction of methyl formate, and 1.02 +- 0.01 for the rate-determining breakdown of T^- to give formyl hydrazide. The former figures are indicative of tetrahedral and the last one of a trigonal transition state. (auth)

21942 ELIMINATION REACTIONS. V. Steric Effects in Hofmann Elimination. Coke, J. L.; Smith, G. D.; Britton, G. H. Jr. (Univ. of North Carolina, Chapel Hill). J. Am. Chem. Soc.; 97: No. 15, 4323-4327(23 Jul 1975).

Earlier Hofmann elimination studies were extended, and the percent syn eliminations in several ring systems have been correlated using cis-d_1 and trans-d_1 models. The measurements of several syn and anti k/sub H//k/sub D/ kinetic isotope effects are reported. Results indicate that Hofmann elimination of N,N,N-trimethyl-3,3-dimethylcyclopentylammonium hydroxide goes by 97 percent syn mechanism to give 3,3-dimethylcyclopentene and by 70 +- 6 percent syn mechanism to give 4,4-dimethylcyclopentene. There appears to be severe steric interactions in the anti mechanism in the 3,3-dimethylcyclopentyl system. Results indicate that, for Hofmann pyrolysis of trimethylammonium hydroxides, cyclopentene is formed by a 39 +- 7 percent syn mechanism, cyclohexene is formed by a 2 +- 2 percent syn mechanism, and cycloheptene is formed by a 30 +- 2 percent syn mechanism. Steric effects on isotope effects and mechanisms are discussed. (auth)

21943 QUANTITATIVE ANALYSIS OF CARBON–CARBON COUPLING IN THE ^{13}C NUCLEAR MAGNETIC RESONANCE SPECTRA OF MOLECULES BIOSYNTHESIZED FROM ^{13}C EN-

RICHED PRECURSORS. London, R. E.; Kollman, V. H.; Matwiyoff, N. A. (Los Alamos Scientific Lab., NM). J. Am. Chem. Soc.; 97: No. 13, 3565-3573(25 Jun 1975).

The quantitative dependence of the intensitities of the various multiplet lines arising from ^{13}C–^{13}C nuclear spin coupling as a function of ^{13}C enrichment is considered. Two cases are distinguished, depending on whether or not the enrichment of the interacting carbons is statistically independent. For statistically independent labeling, the splitting is simply related to the enrichment of the various carbons. For cases in which this condition does not hold, the splitting provides a measure of the correlation in the enrichment of interacting carbons. The quantitative analysis of ^{13}C–^{13}C coupling is shown to provide additional information in biosynthetic experiments in which a correlation in the labeling of the substrates is introduced. In contrast to the information which is obtained by looking for the incorporation of a label into a specific position of a biosynthesized molecule, a quantitative analysis of the correlation in the labeling of the product can give information about the direct incorporation of more complex structural units. Three examples are discussed: the glycolysis of glucose to lactate, the biosynthesis of galactosylglycerol by species of red algae, and the use of doubly labeled acetate to study the biosynthetic incorporation of acetate units into more complex molecules. (auth)

21944 CROSSED BEAM ISOTOPE LABELED STUDIES OF SHORT-LIVED REACTION INTERMEDIATES. $CH_3^+ + C_2H_4$. Smith, G. P. K.; Weiner, J.; Saunders, M.; Cross, R. J. Jr. (Yale Univ., New Haven). J. Am. Chem. Soc.; 97: No. 13, 3593-3600(25 Jun 1975).

Crossed beam studies of the ion–molecule reaction $CH_3^+ + C_2H_4$ yields $C_3H_5^+ + C_3H_3$ and related isotopic variants involving deuterated and ^{13}C labeled reactants indicate that all products are formed by a direct mechanism, as opposed to a long-lived complex. The ionic products are scattered forward over an energy range of 0.7 to 3.0 eV (CM), with only minor kinematic differences among the various isotopic species. A kinetic model of scrambling and dissociation in a near linear intermediate accounts for the observed relative cross sections of the isotopic products. There is some indication protonated cyclopropane intermediates may play a role at lower energies. (auth)

21945 SYNTHESIS AND PHOTOISOMERIZATION OF OPTICALLY ACTIVE 2,2-DIMETHYLPHENYLCYCLOPROPANE-1-d. Mazzocchi, P. H.; Lustig, R. S. (Univ. of Maryland, College Park). J. Am. Chem. Soc.; 97: No. 13, 3714-3718(25 Jun 1975).

Synthesis of (S)-(+)-2,2-dimethylphenylcyclopropane-1-d was carried out starting from phenylacetic acid-2,2-d_2 via a sequence which involved lithium aluminum hydride reduction to 2-phenylethanol-2,2-d_2, then, dehydration at 200° (90 mm) over KOD to alpha-deuteriostyrene. The styrene was converted to its epoxide which was treated with the anion of triethylphosphonopropionate to afford, after hydrolysis, trans-2-phenyl-1-methylcyclopropanecarboxylic acid-2-d. The acid was resolved via its ephedrine salt and converted to (S)-(+)-2,2-dimethylphenylcyclopropane-1-d via a hydride reduction, tosylation, reduction procedure. Irradiation of the active cyclopropane afforded optically active (S)-(+)-2-methyl-4-phenyl-1-butene-4-d. Absolute stereochemistry and optical purity correlations indicate that the hydrogen migration takes place with retention of stereochemistry at the migrating carbon. The mechanism of the reaction is discussed. (auth)

21946 AUTOXIDATION OF ACETALDEHYDE. III. Oxygen-Labeling Studies. Clinton, N. A.; Kenley, R. A.; Traylor, T. G. (Univ. of California, San Diego, La Jolla). J. Am. Chem. Soc.; 97: No. 13, 3757-3762(25 Jun 1975).

The autoxidation of acetaldehyde in solution at 25° was studied using a mixture of 95 percent $^{32}O_2$ and 5 percent $^{36}O_2$. From a comparison of the rates of $^{34}O_2$, $^{32}O_2$, $^{44}CO_2$, and $^{46}CO_2$ evolution, the numbers of oxygen and carbon dioxide molecules evolved for each termination step could be calculated. The results agree with the previous conclusion that the termination process is preceded by the formation of acetyl tetroxide which decomposes completely to methyl radicals, CO_2, and oxygen without appreciable cage collapse. (auth)

21947 THREE-ELECTRON OXIDATIONS. X. Cooxidation of Isopropyl Alcohol and Glycolic Acid. Hasan, F.; Rocek, J. (Univ. of Chicago). J. Am. Chem. Soc.; 97: No. 13, 3762-3766(25 Jun 1975).

The chromic acid oxidation of a mixture of glycolic acid and isopropyl alcohol is a fast cooxidation process yielding acetone and glyoxylic acid in an approximately 2:1 ratio. The mechanism consists in the formation of a termolecular complex of chromium (VI) with glycolic acid and isopropyl alcohol, which decomposes in a rate-limiting step in a three-electron oxidation–reduction process to a molecule of acetone, chromium(III), and a free radical intermediate $HO\dot{C}HCO_2H$ which is subsequently oxidized to glyoxylic acid. The substantial isotope effect observed for both substrates ($HOCH_2CO_2H$–$(CH_3)_2CDOH$, 6.0; $HOCD_2CO_2H$–$(CH_3)_2CHOH$, 5.8; $HOCD_2CO_2H$–$(CH_3)_2CDOH$, 34.4) provides clear evidence for the synchronous breaking of two different C–H bonds in the rate-limiting step. It also represents convincing proof for the proposed three-electron oxidation mechanism. (auth)

21948 EFFECT OF LIGAND AND SOLVENT DEUTERATION ON THE EXCITED STATE PROPERTIES OF THE TRIS(2,2'-BIPYRIDYL)RUTHENIUM(II) ION IN AQUEOUS SOLUTION. Evidence for Electron Transfer to Solvent. Van Houten, J.; Watts, R. J. (Univ. of California, Santa Barbara). J. Am. Chem. Soc.; 97: No. 13, 3843-3844(25 Jun 1975).

Results are reported of the measurement of the luminescence lifetime and quantum yield of the ion in aqueous solution at 25°C. The effect of deuteration of either the ligand, the solvent, or both on the luminescence lifetime and quantum yield was measured. The solvents were H_2O, D_2O, or mixtures of ethanol and methanol. (JSR)

21949 MOLYBDENUM(0) AND TUNGSTEN(0) INTERACTIONS WITH OLEFINS. Direct Observation of Reversible Hydrogen Exchange Processes by Nuclear Magnetic Resonance. Byrne, J. W.; Blaser, H. U.; Osborn, J. A. (Harvard Univ., Cambridge, MA). J. Am. Chem. Soc.; 97: No. 13, 3871-3873(25 Jun 1975).

The mechanism of the interaction of olefins with zerovalent complexes of Mo and W was studied using C_6D_6 and CD_2Cl_2 as solvents. Hydrogen transfer processes central to several catalytic processes were observed. (JSR)

21950 KINETIC, STEREOCHEMICAL, AND MOLECULAR ASSOCIATION FACTORS IN THE HYDRALUMINATION OF GROUP IV SUBSTITUTED ALKYNES. The Role of p/sub pi/-d/sub pi/ Conjugation in the Addition of Diisobutylaluminum Hydride to Trimethyl(phenylethynyl)silane. Eisch, J. J.; Rhee, S. G. (State Univ. of New York, Binghamton). J. Am. Chem. Soc.; 97: No. 16, 4673-4682(6 Aug 1975).

The kinetic, stereochemistry, and molecular association factors for the addition of diisobutylaluminum hydride to trimethyl(phenylethynyl)silane were studied in the temperature range of -10 to 38°. Hydralumination was found to have a kinetic true order of essentially one in the alkyne and one-third in the hydride. Although the trans adduct is the predominating product (approximately 99 percent) after completion of the hydralumination, the variation of the proportion of cis adduct and the initial rate law are consistent with a kinetically controlled cis hydralumination by monomeric R_2^iAlH, followed by a rapid isomerization to the trans adduct. The trans adduct formed a complex with 1 equivalent to the hydride. This complexation had to be taken into account, in order to explain the observed rate retardation and to obtain satisfactory integrated rate expressions for hydraluminations monitored to high conversion. Since in hydralumination this silylacetylene shows a stereospecificity and regiospecificity exactly opposite that of tert-butyl(phenyl)acetylene, as well as a heightened reactivity, a critical consideration of possible p/sub pi/–d/sub pi/ electronic effects was undertaken. The unusually facile isomerization of the resulting silyl-substituted vinylalanes, however, does seem more persuasive evidence for a p/sub pi/–d/sub pi/ effect, which promotes isomerization by electrophilic attack of R_2^iAlH on the carbon alpha to the Me_3Si group. (auth)

21951 SOLUTION CHEMISTRY OF MONENSIN AND ITS ALKALI METAL ION COMPLEXES. Potentiometric and Spectroscopic Studies. Gertenbach, P. G.; Popov, A. I. (Michigan State Univ., East Lansing). J. Am. Chem. Soc.; 97: No. 16, 4738-4744 (6 Aug 1975).

Sodium complex of an antibiotic drug, monensin, was investigated by potentiometric, infrared, and ^{23}Na, ^7Li, ^{13}C, and ^1H NMR techniques in several nonaqueous solvents. The acidity constant of monensin and the stability constant for the monensin–sodium ion complex were determined in methanol solutions. Complexation titrations with other cations show that the selectivity of monensin varies in the order Ag^+ greater than Na^+ greater than K^+ greater than Rb^+ greater than Cs^+ greater than Li^+ approximately NH_4^+. Spectroscopic measurements indicate that monensin forms two sodium complexes of different configuration and stability. These measurements also indicate that water molecules can bind to the monensin molecule at two different sites. Addition of the sodium ion results in water exchange between these two sites and the free water in the solvent. Effects of deuterium substitution on NMR and ir spectra are discussed. (auth)

Isotope Exchange and Isotope Separation

21952 (AECL-5025) DEUTERIUM ISOTOPE SEPARATION FACTOR BETWEEN HYDROGEN AND LIQUID WATER. Rolston,

J. H.; den Hartog, J.; Butler, J. P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1975. 29p. Dep. NTIS (US Sales Only) $4.50. AECL $1.00.

The overall deuterium separation factor between hydrogen and liquid water, α, was measured directly for the first time between 280 and 370°K. Values of the equilibrium constant for isotopic exchange between hydrogen and water vapor, K_l, were evaluated from these measurements and literature values of α_V, the liquid–vapor separation factor. The resulting K_l values are in excellent agreement, within 1%, with recent theoretical estimates of K_l calculated from spectroscopic data. The new data are in good agreement with values of α calculated from measurements of K_l and α_V given in the literature. The combined data for the temperature range 273 to 473°K were fitted by a least squares regression to the equation $\ln \alpha = -0.1636 + (333.7/T) + (33840/T_2)$. The direct measurements of α_V reported in the literature were surveyed and were summarized over the same temperature range, by the equation $\ln \alpha_V = 0.0588 - (80.05/T) + (25440/T^2)$. (auth)

21953 SURFACE AREA OF SULPHIDES BY ISOTOPIC SURFACE EXCHANGE METHOD. Venugopal Chetty, K.; Naidu, P. R. (Sri Venkateswara Univ., Tirupati, (India). Dept. of Chemistry). pp 79-83 of Proceedings of the Chemistry Symposium, Aligarh, December 21-23 1972. Vol. I. Radioisotope Techniques for Chemical and Biomedical Applications, Nuclear and Radio Chemistry, and Radiation Chemistry. Bombay; Department of Atomic Energy (1974).

From chemistry symposium; Aligarh, India (21 Dec 1972).

Specific surface areas of sulfides of mercury(II), cadmium(II) and antimony(III) have been determined by isotopic surface exchange method. The values obtained for the sulfides are reproducible. The results also point out that the surface area values of the three sulfides fall in the order cadmium sulfide > mercuric sulfide > antimony sulfide. This order has been explained in terms of (a) particle size and (b) inclusion of internal surface. (auth)

21954 STEROSELECTIVE HYDROGEN EXCHANGE AT THE METHYLENE GROUP OF GLYCINE IN THE LAMBDA R-(N-BENZYLGLYCINATO)BIS(ETHYLENEDIAMINE)COBALT(III) ION. Golding, B. T. (Univ. of Warwick, Coventry, Eng.); Gainsford, G. J.; Herlt, A. J.; Sargeson, A. M. Angew. Chem. Int. Ed. Engl.; 14: No. 7, 495-496(1975).

A nonenzymatic synthesis of optically pure chiral glycines was achieved by directed exchange of one of the methylene hydrogen atoms of glycine. Chiral glycines are (2R)-^{2}H(or ^{3}H)-glycine and (2S)-^{2}H(or ^{3}H)-glycine. This objective was reached using N-substituted glycinate complexes of cobalt(III). The LAMBDA R-(N-benzylglycinato)bis(ethylenediamine)-cobalt(III) ion was synthesized and its exchange characteristics in D_2O containing PO_4^{3-} ion at pH 10.5 examined. (auth)

21955 SEPARATION OF COMPOUNDS DIFFERING IN ISOTOPIC COMPOSITION. Sievers, R. E.; Brooks, J. J. US Patent 3,891,413. 24 Jun 1975. Filed date 4 Jun 1974. 8p.

Compounds differing in isotopic composition are separated by introducing a mixture of the compounds into a chromatographic column containing a lanthanide chelate as a stationary phase and eluting from the column a fraction that is at least enriched with one of the compounds of the mixture. (auth)

21956 INVESTIGATION OF DEUTERO-HYDROGEN EXCHANGE OF CYCLIC HYDROCARBONS ON METALLIC CATALYSTS. III. Kinetic Analysis of the Reaction of Deutero-Hydrogen Exchange of Cyclohexane on a Platinum Catalyst. Nekrasov, N. V.; Gudkov, B. S.; Kiperman, S. L. (Inst. of Organic Chemistry, Moscow). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 11, 2369-2374(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 11, 2456-2462(Nov 1974).

The rate of the reaction of isotopic exchange of cyclohexane with deuterium on a Pt catalyst is described by the same kinetic equation as on a Ni catalyst. The rates of the reaction along individual pathways (initial rates of formation of deutero-products) on a Pt catalyst are a constant fraction of the summary rate of exchange. This substantially facilitates the problem of determining the isotopic distribution at any moment of the reaction at any values of the concentrations of the starting materials. (auth)

21957 MECHANISM OF CATALYTIC HYDROGENATION OF TOLUENE OF NICKEL CATALYST. Mamaladze, L. M.; Gudkov, B. S.; Kiperman, S. L. (Inst. of Organic Chemistry, Moscow). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 11, 2512-2514 (Nov 1974).

Translated from Izv. Akad, Nauk SSSR, Ser. Khim.; 23: No. 11, 2605-2607(Nov 1974).

The rules for the isotopic exchange of hydrogen with deuterium in toluene under the conditions of its hydrogenation on a nickel–zinc oxide catalyst and the values of the kinetic isotope effects in this reaction, obtained during the replacement of protium by deuterium, indicate a difference in the mechanisms of toluene hydrogenation and isotope exchange, and confirm the hydrogenation scheme that was proposed on the basis of the kinetic data. (auth)

21958 DONOR–ACCEPTOR COMPOUNDS OF BORON TRIFLUORIDE. III. Effect of Substituents on Isotopic Equilibrium in Systems Containing Substituted Anisole and Phenetole Complexes. Katal'nikov, S. G.; Voloshchuk, A. M.; Kozik, T. A. (Moscow Inst. of Chemical Tech.). Russ. J. Phys. Chem.; 48: No. 11, 1688(Nov 1974).

Translated from Zh. Fiz. Khim.; 48: No. 11, 2874-2875(Nov 1974).

Separation coefficients (α) for boron isotopes were measured in the exchange between BF_3 and its complexes with o-, m-, p-, and chloro-anisoles, and with p-bromophenetole. The dependence of the α coefficient on the nature of the substituent in the complexing agent is confirmed. (auth)

21959 CONFORMATIONAL ANALYSIS OF PEPTIDES IN ORIENTED POLYOXYETHYLENE BYE INFRARED DICHROISM. Ingwall, R. T.; Gilon, G.; Goodman, M. (Univ. of California, San Diego, La Jolla). J. Am. Chem. Soc.; 97: No. 15, 4356-4362 (23 Jul 1975).

A new procedure for the determination of infrared dichroic spectra of oligo- and polypeptides is described. The peptide is incorporated in a polyoxyethylene film and partially oriented by uniaxial stretching. The infrared characteristics of the polyoxyethylene support allow measurement of the dichroic spectra of amide N–H stretching bands between 3500 and 3000 cm^{-1}, of amide I and II bands between 1700 and 1500 cm^{-1}, and of far-infrared bands below 800 cm^{-1}. Procedures for measuring the kinetics of N–H to N–D isotopic exchange reactions of molecules oriented in polyoxyethylene are described. The infrared dichroic spectra of gramicidin S and of several synthetic oligo- and polypeptides are presented. Gramicidin S exhibits a "cross-beta" dichroic spectrum which could arise from extensive association of the beta-sheet conformation of Hodgkin–Oughton and Schwyzer into ribbon-like aggregates. Polypeptides were found to be oriented in the alpha-helical, beta-sheet, and "cross-beta" conformation in polyoxyethylene films. (auth)

Feed Materials Processing

21960 RECOVERY OF URANIUM FROM HCl DIGESTED PHOSPHATE ROCK SOLUTION. Wamser, C. A. (to Allied Chemical Corp.). US Patent 3,880,980. 29 Apr 1975. Filed date 30 Nov 1972. 12p.

Uranium is recovered from a solution containing phosphoric acid, uranium in the hexavalent state and a chloride salt from the group consisting of alkali metal chloride, alkaline earth metal chloride, ammonium chloride and mixtures thereof, such as a solution obtained by hydrochloride acid digestion of phosphate rock. The phosphoric acid is extracted from the solution before the uranium is recovered from the remaining constituents thereof. Extraction degradation and emulsification of the organic layer previously employed in organic solvent extraction methods are eliminated, and the uranium is recovered at low cost and in a highly efficient manner. (auth)

Radiation Chemistry

Refer also to abstracts 21896, 22016, 22026, 22055, 22453, 22470, 22755, 22938–22940, and 23512.

21961 (AED-CONF-75-061-011) GAMMA IRRADIATION FOR SEWAGE TREATMENT AT US ARMY FACILITIES. van den Berg, A. J.; Hollis, H. D.; Musselman, H. D.; Lowe, H. N.; Woodbridge, D. D. (Office of the Chief of Engineers, Washington, D. C. (USA)). 1975. 7p. (SM-194/305). INIS.

From international symposium on the use of high-level radiation in waste treatment. Status and prospects; Munich, Germany (17 Mar 1975).

11 refs. With abstract. Available from ZAED.

The US Army Corps of Engineers has been sponsoring research for many years on the use of gamma irradiation for disinfection and sterilization of sewage plant effluents. Initial research was directed to laboratory experiments to determine the effects of gamma irradiation on E. coli, M-pyogenes and M-smegmatis organisms and on the chemical constituents of sewage such as phenols, surfactants, and pesticides. Current research is directed towards investigating the effects of radiation on the constituents of sewage sludge and on the cyst stage of the amoebic protozoa. Consideration has been given by the Corps to the management of

wastewaters by disposal on land. Legal and medical reasons dictate that the plant effluents be sterilized before being used as fertilizers and soil conditioners. Gamma radiation from isotopic sources appears to be the best source of sterilizing energy for Army wastewater disposal. Construction of an experimental gamma irradiation pilot facility to validate laboratory experimental work and to establish design criteria for operating plants is being considered. (auth)

21962 (AED-CONF-75-061-047) TREATMENT OF EXHAUST GASES BY IRRADIATION. Kawamura, K.; Aoki, S.; Kawakami, K.; Hashimoto, S.; Machi, S. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). 1975. 11p. (SM-194/707). INIS.

From international symposium on the use of high-level radiation in waste treatment: Status and prospects; Muenchen, F. R. Germany (17 Mar 1975).

11 figs.; 2 tabs.; 5 refs. With abstract. Available from ZAED.

Results from studies on the behavior of noxious gases, such as oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) contained in heavy oil combustion gas, under the irradiation of electron beams are reported. Experiments were carried out in batch system using a box-type reactor (22.5 l) and an electron linear accelerator. The results of the experiments revealed that SO_2 contained in the gas could be removed almost completely by irradiation with a total dose of 3 Mrads. At the same time the formation of fine solid particles suspended in the irradiated gas was observed. Significantly NO_x as well as SO_2 were found to be simultaneously removed by irradiation, and the product to be a mixture of fine solid particles and mists of sulfuric acid (H_2SO_4) which can be collected by an electrostatic precipitator. In case of heavy oil combustion gases (10 Nm^3/H) containing SO_2 of 600 to 900 ppm and NO_x of ca. 80 ppm, the removal efficiency of SO_2 was 80% with irradiation of 4 Mrads, and more than 99% for NO_x with irradiation of 2 Mrads. (auth)

21963 (ERDA-tr-31, pp 51-56) OXIDATION OF CARCINOGENIC POLYCYCLIC HYDROCARBONS IN THE PRESENCE OF OLEIC ACID UNDER THE ACTION OF IONIZING RADIATION. Tarusov, B. N.; Novikov, V. E.; Petrusevich, Yu. B. (Moscow State Univ.). 1974. Translated from Radiobiologiya; 14: No. 6, 842-846(1974).

In Radiobiology.

The dependence of the breakdown of carcinogenic polycyclic hydrocarbons in oleic acid on the degree of its oxidation was investigated. Ionizing radiation was used as a factor initiating autooxidation. The influence of antioxidants on the degree of decomposition of carcinogens was studied. A correlation of the degree of breakdown of the carcinogen and the rate of oxidation of oleic acid was obtained. The question of the mechanism of the action of antioxidants is discussed. (tr-auth)

21964 (NP-20444, pp 44-45) RADIOLYSIS OF Cu^{II}-EDTA IN ALKALINE AQUEOUS SOLUTION. Bhattacharyya, S. N.; Kundu, K. P. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21965 (NP-20444, pp 45) RADIOLYSIS OF NITRILOTRIACETIC ACID IN AQUEOUS SOLUTION. Bhattacharyya, S. N.; Srisankar, E. V. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21966 (NP-20444, pp 45-46) PRIMARY YIELDS AT VARIOUS LET IN NEUTRAL AQUEOUS SOLUTION. Kundu, K. P.; Bhattacharyya, S. N. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21967 (NP-20444, pp 46-48) RADIOLYSIS OF Co^{III}-EDTA IN AQUEOUS SOLUTIONS. Bhattacharyya, S. N.; Kundu, K. P. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

21968 FORMATION OF SUPEREXCITED ORGANIC SPECIES IN FIELD IONIZATION SOURCES. Brown, H. L.; Anbar, M. (Stanford Research Inst., Menlo Park, CA). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 281-291(Apr 1975).

Collisionally produced superexcited states of organic molecules were observed in a quadrupole mass spectrometer employing a field ionization source. The production and detection of these superexcited molecules is unique to the experimental arrangement and, therefore, escaped earlier observation in other spectrometers. The mechanism of formation of the superexcited molecules involves the collision of highly energetic ions with a solid surface. These species are ionizable in a time-dependent field. A lower limit on the lifetime of the excited isolated molecules is found to be $\approx 10^{-6}$ s. (auth)

21969 DISSOCIATIVE ELECTRON CAPTURE OF FLUORINATED ACETIC ACIDS. Shiotani, M.; Imura, D.; Murabayashi, S.; Sohma, J. (Hokkaido Univ., Sapporo). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 265-274(Apr 1975).

In order to demonstrate the dissociative electron captures of fluorinated acetic acids, ESR studies were carried out on these substances in solid matrices, such as ethanol, methyltetrahydrofuran (MTHF) and 10 mol dm^{-3} NaOH alkaline ice, which are known to trap electrons produced by γ-irradiation. Analyses of the observed spectra of these mixtures indicate that the fluoroacetic acids capture electrons dissociatively to produce $\dot{C}FHCOOH$ of $\dot{C}F_2COOH$ radicals. A similar experiment performed with glasses of either ethanol or MTHF containing the fluoroacetic acids and tetraphenyl-p-phenylenediamine (TMPD), and from which photoelectrons are released by U.V. light, showed that photoelectrons also dissociatively attach to the fluoroacetic acids. Discrepancies between these experimental results and the theoretical anticipation are discussed. (auth)

21970 SPECIFIC POSSIBILITIES OF COMBINED RADIATION AND LASER ACTION ON SUBSTANCES. Goldanskii, V. I. (Inst. of Physical Chemistry, Moscow). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 339-343(Apr 1975). (In Russian).

A typical consequence of interaction of ionizing radiation with various substances is the excitation of electronic levels whereas, in transitions induced by laser radiation, vibrationally excited levels usually play a large part. The combination of radiation and laser action opens up the possibility of directed changes of radiolytic mechanism and yield, stimulating certain transitions between the vibrational-rotational bands of electronically excited and ground states. An interesting particular case of such a combination is the possibility of an increase of radiation stability (i.e., a decrease of dissociation probability) of molecules having their first electronically excited level above the dissociation energy of the weakest bond, by use of laser irradiation or reflecting mirrors. A selective laser-induced dissociation of molecules from radiolytically populated electronically excited levels below the dissociation energy also seems to be possible. (auth)

21971 EXISTENCE OF DIELECTRONS IN AQUEOUS SOLUTIONS. Meisel, D.; Czapski, G.; Matheson, M. S.; Mulac, W. A. (Hebrew Univ., Jerusalem). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 233-241(Apr 1975).

Alkaline aqueous solutions under high H_2 pressures when pulse radiolyzed should favor the formation of dielectrons through the reaction $e^-_{aq} + e^-_{aq} \rightarrow (e^{-2}_2)_{aq} \rightarrow H_2 + 2OH^-$. In a pulse radiolysis investigation of such solutions, no uv absorption, which can be attributed to the decay of e^-_{aq}, remains after the decay of e^-_{aq}. It is concluded that either dielectrons scarcely absorb any light in the region where e^-_{aq} absorbs or else the dielectron is quite short-lived as compared to the lifetime of e^-_{aq} under these conditions. (auth)

21972 FORMATION OF PRIMARY REDUCING YIELDS (G^-_{aq} AND G_{H_2}) IN THE RADIOLYSIS OF AQUEOUS SOLUTIONS OF SOME POSITIVE IONS. Draganic, Z. D.; Draganic, I. G. (Institut za Nuklearne Nauke Boris Kidric, Belgrade). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 381-386(Apr 1975).

The formation of primary reducing yields in aqueous solutions of some metallic ions (M^{n+}) with different solute reactivities toward e^-_{aq} ($k^-_{e_{aq}} + M^{n+}[M^{n+}]$, in reciprocal seconds) was investigated; M^{n+} was Cd^{2+}, Zn^{2+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Pb^{2+} and Tl^+. An increase in solute reactivities leads simultaneously to an increase in $G^-_{e_{aq}}$ and to a decrease in G_{H_2}, which is in agreement with previous observations on solutions containing other types of e^-_{aq} scavengers. This study also confirms that the yield-reactivity curves for both e^-_{aq} and H_2 gradually change on the sub-nanosecond time scale, contrary to what one would expect from the e^-_{aq} behavior observed in the picosecond pulse radiolysis. (auth)

21973 ELECTRONIC STATES IN CONCENTRATED POTASSIUM HYDROXIDE SOLUTIONS. Shubin, V. N.; Slepneva, L. F.; Maiboroda, V. D. (Inst. of Electrochemistry, Moscow). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 371-379(Apr 1975). (In Russian).

The absorption spectra were studied of the local electronic states induced by the action of a 50-nsec pulse from a U-10 accelerator (E = 8 MeV and pulse current up to 1.5A). Superposition of Gaussian bands belonging to two different electronic states immediately after the action of a pulse has been confirmed. The effects of temperature are discussed. The results and inferences of processing the decay kinetics of the short-lived spectrum by computer are reported. The constant for the effective decay of F-centers increases with an increase in temperature and the calculated activation energy is ~8 kcal/mole. The pre-exponential factor is -1.75×10^{16}, i.e., greater than the number of collisions,

which indicates the nontrivial nature of the decay process. The nature of the particles is discussed. (auth)

21974 PHENOMENOLOGY OF RECOMBINATION LUMINESCENCE FROM TRAPPED ELECTRONS AND TETRAMETHYL-p-PHENYLENEDIAMINE CATION ($TMPD^+$) IN METHYLTETRAHYDROFURAN GLASS AT 77°K. Moeckel, H.; Yuen, J.; Kevan, L. (Wayne State Univ., Detroit). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 251-163(Apr 1975).

The recombination luminescence from trapped electrons (e_t^-) and N,N,N',N'-tetramethyl-p-phenylenediamine cation ($TMPD^+$) in methyltetrahydrofuran glass at 77°K following polarized photoionization of TMPD has been studied. Both fluorescence (F) and phosphorescence (P) have been detected during UV excitation, after U.V. excitation (isothermal luminescence), and after U.V. excitation with additional stimulating light (stimulated luminescence) which detraps e_t^-. Polarized emission has been measured following polarized excitation and the results have been compared with theoretical polarization ratios. The TMPD triplet lifetime is 2.8 s. The initial lifetime of the isothermal luminescence depends on the excitation energy and indicates that larger average e_t^-, $TMPD^+$ distance distributions are produced for higher energy excitation. The F/P ratio from stimulated luminescence depends strongly on the stimulating wavelength; only phosphorescence is observed at wavelengths >900 nm. This differs from previous results in less polar alkane matrices. At low stimulating light energy, it is suggested that recombination occurs by tunnelling from an excited state of e_t^- which only has sufficient energy to produce triplet TMPD. At high stimulating light energy e_t^- is excited to a conduction state from which it can recombine with $TMPD^+$ to produce both singlet and triplet TMPD. In alkane matrices it appears that only the second process is observed in the accessible stimulating wavelength range. (auth)

21975 REACTION OF HYDROXYL RADICALS WITH CARBON AT 298°K. Mulcahy, M. F. R.; Young, B. C. (Commonwealth Scientific and Industrial Research Organization, North Ryde, Australia). Carbon; 13: No. 2, 115-124(Apr 1975).

The reaction of free OH radicals with graphite was studied in a flow system by mass spectrometry, the OH being produced by the reaction $H + NO_2 \rightarrow OH + NO$. The OH radicals react rapidly at 298°K to produce approximately equal amounts of CO and CO_2. The collision efficiency (γ) for gasification of the carbon is $>5 \times 10^{-3}$. Hydroxyl radicals are much more reactive than free oxygen atoms towards graphite at 298 K. Carbon is an efficient heterogeneous catalyst for the reaction $H + OH \rightarrow H_2O$ and when free hydrogen atoms are present, this reaction is several times faster than the gasification of the carbon by OH. Carbon is also an efficient catalyst for the recombination of H atoms: $2H \rightarrow H_2$. (auth)

21976 FORMATION OF LATENT HEAVY-ION TRACKS AND CHEMICAL DAMAGE INDUCED BY ION OR ELECTRON BEAMS IN POLY(METHYLMETHACRYLATE). Bernas, A.; Chembaudet, A.; Roncin, J. (Univ., Paris). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 447-455(Apr 1975). (In French).

Upon electron irradiation of samples of polymethyl methacrylate, the classical ESR signal S_1 is observed, corresponding to the growing chain radical R_1. On the other hand, following Kr or Ar ion bombardment a composite signal $S_1 + S_2$ is recorded. S_2 alone is present after heavy doses or after annealing lightly irradiated samples. S_2 shows no hyperfine structure and is 18 G wide. S_2 could be an envelope signal corresponding to various R_2 radicals with the free electron extending over a larger or smaller number of carbon cycles or conjugated linear chains. It is suggested that R_2 type radicals arise from the exothermic recombination of R_1 pairs in the ion track core. (auth)

21977 RADIOLYTIC FORMATION OF MOLECULAR HYDROGEN FROM BIPHENYL, NAPHTHALENE AND METHYLNAPHTHALENES. Bartonicek, B.; Janovsky, I.; Bednar, J. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 431-445(Apr 1975).

In solid or liquid biphenyl, naphthalene, methylnaphthalenes and in mixtures of these compounds, molecular hydrogen is formed by ionizing radiation with two distinct yields $G_1(H_2)$ and $G_2(H_2)$. In the smaller part, $G_1(H_2)$, presumably high energy processes like the Auger effect, etc. are involved, but also the abstraction reaction of thermalized H atoms on the aromatic ring. The larger part, $G_2(H_2)$, is supposed to originate from monomolecular decay of low energy localized excited electronic states of the aromatic π-electron system of molecules. In solids the excitations are in the form of molecular excitons, while in liquids they are in the form of excited molecules. The kinetics of these processes is qualitatively discussed and the optical approximation is used for comparison of yields of the excited states with the experimental yields $G_2(H_2)$. (auth)

21978 EFFECT OF THE PHYSICAL STATE ON THE FINAL PRODUCTS IN THE GAMMA RADIOLYSIS OF CYCLOHEXANE. Gracheva, T. A.; Makarov, B. N. (Inst. of Petrochemical Synthesis, Moscow). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 425-429(Apr 1975). (In Russian).

Measurements have been made of the radiation yields of fragments formed by the rupture of C-C bonds during the irradiation of solid and liquid cyclohexane over the temperature range −196 to +96°C. In the region of the polymorphic transformation temperature of cyclohexane (186°K) a well-defined phase effect has been detected. In this region the ratio of the yields of saturated and unsaturated fragments exceeds by several factors of ten the corresponding values measured at lower and higher temperatures for the solid phase. The anomalies observed are associated with the existence of a so-called gas-crystalline state in cyclohexane. (auth)

21979 INFLUENCE OF AN ELECTRIC FIELD ON THE RADIOLYSIS OF GASEOUS CYCLOHEXANE. Milon, H.; Gaeumann, T. (Ecole Polytechnique, Lausanne, Switzerland). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 417-424(Apr 1975).

The radiolysis of cyclohexane has been studied at pressures of 1 and 20 torr. A previous model explaining the pressure dependence has been generalized in order to accommodate the influence of an applied electric field on the G-values. Competition between the fragmentation of excited cyclohexane ions and their deactivation, followed by neutralization either in volume or on the surface, is proposed. Results with SF_6 added as an electron scavenger gives additional support to the model. (auth)

21980 RADIOLYSIS OF AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL. Pikaev, A. K.; Kartasheva, L. I. (Inst. of Physical Chemistry, Moscow). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 395-415(Apr 1975).

Experimental results obtained by the authors during the study of γ-radiolysis of ethylene glycol aqueous solutions are reviewed. The radiation chemical yields of hydrogen, hydrogen peroxide, formaldehyde, acetaldehyde, succinic and glycolic aldehydes and acetate ions are given as functions of alcohol concentration, pH values, dose rate, nature of gas saturating the solution, and Fe^{2+} additions. The possible mechanism of radiolytic transformations in the system under consideration is discussed. This mechanism is based on the formation of peroxy radical $CH_2OHCHOHO_2$ from $CH_2OHCHOH$ in the solutions containing oxygen, the partial rearrangement of radical $CH_2OHCHOH$ into CH_2CHO in deaerated neutral and acid solutions and the transformation of CH_2CHO into $CH_2 = C-O^-$ in deaerated alkaline solutions. (auth)

21981 PICOSECOND PULSE RADIOLYSIS. VI. Fast Electron Reactions in Concentrated Solutions of Scavengers in Water and Alcohols. Lam, K. Y.; Hunt, J. W. (Univ. of Toronto). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 317-338(Apr 1975).

Reactions of solvated electrons, e_s^-, have been studied at high concentrations of e_s^- scavengers in water and some aliphatic alcohols. The initial yield of e_s^- in all solvents studied was reduced in the presence of a high concentration of scavengers, and exhibited a semi-logarithmic dependence on the scavenger concentration. There is a correlation between the efficiency, $1/C_{37}$, of a scavenger in reducing the initial yield of e_s^- and the reaction rate constant k_{e-}, measured at high concentration of the scavenger with e_s^-: namely $k_{e-} \cdot C_{37}$ = constant. The constant is about 1.0×10^{10} s^{-1} in water, 5×10^9 s^{-1} in ethylene glycol and 1.3×10^9 s^{-1} in ethanol. These results suggest that there are reactive precursors to e_s^- in both water and alcohols. (auth)

21982 EARLY EVENTS OF RADIATION CHEMISTRY. Mozumder, A.; Magee, J. L. (Univ. of Notre Dame, IN). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 83-93(Apr 1975).

A critical review of the early events of radiation chemistry is presented with special reference to aqueous solutions and liquid hydrocarbons. It is concluded that a judicious combination of both direct and indirect methods must be used to get a complete picture of the early events. Proper interpretation of scavenging experiments plays a key role in the indirect methods. Contact reactions at very short times ($\approx 10^{-13}$s) must also be considered in concentrated solutions. The aim of the paper is not to develop any particular model in detail but to analyze the natural limitations of model construction. It appears that, for different reasons, there are "barriers" on the short time scale for both direct and indirect methods combined with early real-time measurements allows investigation of events behind these barriers. (auth)

21983 COLLECTIVE ELECTRON EFFECTS IN MOLECULAR LIQUIDS. Williams, M. W.; Hamm, R. N.; Arakawa, E. T.; Painter, L. R.; Birkoff, R. D. (Oak Ridge National Lab., TN). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 95-108(Apr 1975).

A knowledge of the interactions of radiation with molecular liquids such as glycerol, water and benzene has direct biological application in terms of understanding radiation damage to living material. Not only the amount of energy but the modes of energy deposition can be extracted from the dielectric functions if these are known over a sufficiently wide energy range. The experimental techniques and methods of data analysis which yield the dielectric functions are reviewed. The conditions necessary for the existence of collective electron effects in molecular liquids are considered and the collective behavior associated with a single oscillator and with a collection of oscillators is compared with the behavior of a free-electron gas. Experimental spectra for some molecular liquids in the energy region from 0 to 26 eV are analyzed for the degree of collective behavior exhibited. (auth)

21984 MOBILITIES OF SLOW ELECTRONS IN LOW- AND HIGH-PRESSURE GASES AND LIQUIDS. Christophorou, L. G. (Oak Ridge National Lab., TN). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 205-221(Apr 1975).

The mobility, μ, of thermal electrons in molecular gases decreases with increasing magnitude of the permanent molecular electric dipole moment D. For small values of $D(\rightarrow 0)$, μ decreases with increasing static polarizability. Distinct submolecular characteristics of the molecular structure affect μ. Thus μ was found to decrease with increasing number of doubly occupied π-electron orbitals for a number of linear, cyclic and aromatic hydrocarbons. For linear hydrocarbons with two double occupied π-electron orbitals, μ increases with increasing separation of the two π-orbitals. The dependence of μ on the mean electron energy is also given for a number of organic molecules. The recently discovered large and varying effects of pressure on the electron mobility in high-pressure gases are summarized and discussed. For a number of relatively spherical hydrocarbons, and for the heavier rare-gas atoms, thermal electrons seem to be more mobile in the liquid than in the gaseous phase. Evidence seems to indicate that this behavior is due to scattering potentials in the liquid state. (auth)

21985 PUBLICATIONS. Platzman, R. L. Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 51-54(Apr 1975).

The publications are chiefly in the fields of radiation chemistry and radiobiology, with a smaller proportion in the fields of radiation physics, atomic and molecular physics. (UK)

21986 RADIATION CHEMICAL YIELD AND MOBILITY OF ELECTRONS IN LIQUID HYDROCARBONS. Schiller, R.; Vass, S. (Kozponti Fizikai Kutato Intezet, Budapest). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 193-203(Apr 1975).

Geminate ion-electron recombination is reconsidered theoretically and compared with the experimentally observed interdependence between free ion yield, G_{fi} and electron mobility, μ or quasi-free electron energy, V_0. Thermal electrons are regarded as being formed in the quasi-free state, hence their motion can be described as that of a spherical wave with the geminate positive ion in the center. It can be shown that the escape probability of thermal quasi-free electrons equals about one-half in each and any system if electron scattering by the molecules is neglected. Further it is assumed that the escape fraction of quasi-free electrons partially localize in the liquid. In this second stage of their life localized electrons behave as heavy particles in that they obey Onsager's recombination law. The distribution of distances between ions and localized electrons, as essential function in the Onsager theory, can be expressed in terms of trapping probability which is a function of either V_0 or μ. Calculated $G_{fi}(V_0)$ and $G_{fi}(\mu)$ curves adequately agree with experiment. (auth)

21987 STRUCTURE IN THE OPTICAL ABSORPTION SPECTRUM OF THE SOLVATED ELECTRON. Gavlas, J. F.; Dorfman, L. M. (Ohio State Univ., Columbia). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 227-231(Apr 1975).

The optical absorption spectrum of the solvated electron in ethanol has been determined again to establish whether a report of observed structural features by Vannikov and Marevtsey (Int. J. Radiat. Phys. Chem.; 5: 453 (1973)) which appears to be discordant with earlier data, can be sustained. The data here presented do not reveal such structural features, and are, furthermore, in significant disagreement with the general contour of the absorption band reported by these authors. (auth)

21988 ABSOLUTE IONIZATION YIELDS IN A THICK FILM UNDER THE ACTION OF IONIZING RADIATION. II. Hydrocarbons and Some Substances of Biological Interest. Durup, J.; Platzman, R. L. (Univ., Paris). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 121-136(Apr 1975). (In French).

The processes which follow K shell ionization of a carbon atom in a hydrocarbon molecule may lead to important changes. A method is described which allows computation of the yield of K ionizations during irradiation of a hydrocarbon by fast electrons or by X or γ rays, the effects of which are essentially due to fast secondary electrons. The numerical calculations are carried out for the ejection of inner-shell electrons from carbon atoms in polyethylene through total absorption of monoenergetic electrons of 300 eV to 4 MeV. The absolute yield (with respect to absorbed energy) increases with incident electron energy and reaches at 4 MeV 0.0305 K ionizations per 100 eV absorbed. The yields of K ionizations are computed in the same way for x or γ irradiation. The results are generalized to any hydrocarbon and to some organic derivatives such as proteins. The effect of L_I ionization of these compounds is also considered. (auth)

21989 YIELDS OF EXCITED SINGLET STATES OF SOME SATURATED HYDROCARBON LIQUIDS WHEN EXCITED BY FAST ELECTRONS. Walter, L.; Lipsky, S. (Univ. of Minnesota, Minneapolis). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 175-182 (Apr 1975).

G values have been measured for the production of the lowest excited singlet states of cyclohexane, methylcyclohexane, 2,3-dimethylbutane, dodecane, hexadecane, cis-decalin and bicyclohexyl. The technique is based on comparison of the fluorescence intensities of these liquids with that of neat benzene. Comparison of the results obtained in this manner with those obtained via a solute sensitization technique indicate, at least for cyclohexane, that the solute technique may strongly underestimate the true G value. (auth)

21990 EFFECT OF THE VISCOSITY OF SOLUTIONS ON THE ACTIVATION ENERGIES OF REACTIONS OF THE SOLVATED ELECTRON. Cercek, B. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 223-226(Apr 1975).

The effect of the viscosity of solutions on the rate constant and activation energy of reactions of the solvated electrons with nitrobenzene, $C_6H_5NO_2$, carbon tetrachloride, CCl_4, and acetone, CH_3COCH_3, were studied. The effect on the rate constants is inversely proportional to the 0.66 power of the viscosity. The activation energies of these reactions, $E(e_{solv} + S)$, are linearly related to the activation energies for viscous flow of solutions, E_{vis}, i.e., $E(e_{solv} + S) = (\alpha \cdot E_{vis} + \beta)$. It is suggested that the value of β represents the activation energy for the accommodation of the extra electron in the substrate molecule. (auth)

21991 FORMATION AND DECAY OF SUPEREXCITED STATES IN DENSE ORGANIC MATTER UNDER HIGH ENERGY RADIATION. Klein, G.; Voltz, R. (CNRS, Strasbourg, France). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 155-174(Apr 1975).

The elementary processes in the early stages of the response of dense organic matter to high energy radiation are considered. Special attention is given to the specific features in condensed phases. Primary excitation generally involves plasmons, but these rapidly convert into high energy excitons of the medium. The subsequent "physicochemical" stage of radiation action is determined by the monomolecular and bimolecular electronic transitions from the upper exciton states, which are examined in the light of photophysical studies with organic crystals. Among the monomolecular decay processes, internal conversion dominates for excitation energies below the ionization potential of the crystal; for higher energies, autoionization is found to be in true competition with intramolecular relaxation, so that some of the characteristic features of superexcited states of isolated molecules are retained in dense media. In addition, however, transitions from the upper singlet levels to pair states of lower triplet or singlet excitons of the material may be highly efficient. These new electronic relaxation phenomena ("exciton fission") are investigated in detail because they are expected to be of primary importance in the early radiation effects in dense organic matter: in molecular crystals (anthracene, etc.), fission of upper excitons into a triplet pair is analyzed through fine structure modulation of prompt fluorescence, while the transitions to singlet pairs are studied by following the correlated emission of two photons by coincidence techniques. Meaning and implications of the experimental data are discussed. (auth)

21992 ELECTRIC FIELD EFFECT ON FREE ION YIELDS IN X-IRRADIATED LIQUIDS. A Multipair Spur Model. Dodelet, J. P.; Freeman, G. R. (Alberta Univ., Edmonton, Canada). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 183-192(Apr 1975).

The free ion yield in an irradiated dielectric liquid increases with increasing applied electric field strength. The theoretical treatment of the field effect has been extended to take account of spurs that contain more than one ion-electron pair. The multipair-spur (MPS) model was applied to three liquids, beginning with one that has a large free ion yield (xenon) and proceeding through those with progressively smaller free ion yields (neopentane and 1,6- heptadiene). Water was also examined briefly. The

effect of multipair spurs is not discernible when the average free ion formation probability is small, $\beta_n^g < 0.05$, because a negligible of electrons from multipair spurs becomes free ions. However, the MPS model offers a more realistic interpretation of results from liquids in which the escape probability is large. The electron ranges estimated in the MPS model are equal to those in the single-pair-spur (SPS) model for liquids with low values of β_n^g, but the ratio [range (MPS)/range (SPS)] increases with increasing β_n^g. (auth)

21993 IONIC PROCESSES IN CUMENE AND P-XYLENE. Gangwer, T. E.; Thomas, J. K. (Univ. of Notre Dame, IN). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 305-316(Apr 1975).

Pulse radiolysis and γ-radiolysis data are presented, which indicate that ions play a more significant role in the production of excited states in the liquid alkyl benzenes than previously thought. A lower limit to the excited state yield produced via ion precursors in the condensed phase is G ≈ 1.0. The ^{60}Co γ-irradiation of pure cumene glass at 77°K gives rise to trapped species shown to be the cation and anion of cumene both having spectral maxima at 400 and 555 nm. Ion neutralization results in the formation of the excited single state of cumene. Excitation of p-xylene to the third excited state by two photon laser excitation with γ = 3471 Å light shows that this state may be quenched by the ion scavengers methanol and N_2O. (auth)

21994 PULSE RADIOLYSIS STUDY OF THE REACTION OF THE HYDRATED ELECTRON WITH TERT-BUTYL ALCOHOL. Teather, G. G.; Klassen, N. V. (National Research Council of Canada, Ottawa). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 475-477(Apr 1975).

In pure tert-butyl alcohol (t-BuOH) at 27°C, the upper limit for $k(e_{aq}^- + t\text{-BuOH})$ is 2.5×10^4 dm^3 mol^{-1} s^{-1}. In aqueous solution, the upper limit for $k(e_{aq}^- + t\text{-BuOH})$ is 10^4 dm^3 mol^{-1} s^{-1}. However, solutions of commercial t-BuOH used without special treatment give much higher apparent rate constants, and would be unsuitable for many experiments in which t-BuOH is intended to scavenge OH radicals only. (auth)

21995 PROCESS OF TREATING SURFACES OF METALS. Kimura, T.; Murao, A.; Kuwahara, T. (to Nippon Kokan Kabushiki Kaisha). US Patent 3,873,349. 25 Mar 1975. Priority date 12 Mar 1971, Japan. 8p.

Both higher corrosion resistance and paint adherence are given to films formed on the surfaces of metals by treating the surfaces with aqueous solutions of one or more materials selected from the group consisting of water soluble vinyl monomer or water soluble high polymer and then irradiating with ionizing radioactive rays on the nearly dried surface film. When a water soluble inorganic compound is mixed with the above mentioned aqueous solution, the film properties are greatly improved. The inorganic ionic material should contain a cation from the group consisting of Ca, Mg, Zn, Cr, Al, Fe, and Ni. Electron beams may be used. (auth)

21996 IONIZING RADIATION METHOD FOR FORMING ACRYLIC PRESSURE SENSITIVE ADHESIVES AND COATED SUBSTRATES. Dowbenko, R.; Christenson, R. M. (to PPG Industries, Inc.). US Patent 3,897,295. 29 Jul 1975. Filed date 2 Jun 1972. 10p.

Pressure-sensitive adhesive having improved adhesive properties are formed by subjecting a mixture comprising a monomer selected from the group consisting of alkyl acrylates, hydroxyalkyl acrylates, alkoxyalkyl acrylates, cyanoalkyl acrylates, alkyl methacrylates, hydroxyalkyl methacrylates, alkoxyalkyl methacrylates, cyanoalkyl methacrylates, N-alkoxymethylacrylamides, and N-alkoxymethylmethacrylamides, and a homopolymer or copolymer selected from the group consisting of polymers of alkyl acrylates, hydroxyalkyl acrylates, alkoxyalkyl acrylates, cyanoalkyl acrylates, alkyl methacrylates, hydroxyalkyl methacrylates, alkoxyalkyl methacrylates, cyanoalkyl methacrylates, acrylamide, methacrylamide, N-(substituted alkyl) acrylamides, N-(substituted alkyl) methacrylamides, alkyl acrylamides, alkyl methacrylamides, and N-alkoxymethylacrylamides and N-alkoxymethylmethacrylamides to ionizing irradiation. The adhesive material finds utility as binding resins in laminates, coatings on substrates, and as film adhesives. (Official Gazette)

21997 MAXIMUM YIELD OF SEPARATED ION PAIRS IN POLAR GLASSES, γ-IRRADIATED AT 77°K. Gaponova, I. S.; Ershov, B. G. (Inst. of Physical Chemistry, Moscow). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 11, 2366-2368(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 11, 2453-2456(Nov 1974).

The influence of electron acceptors on the process of separation of primary ion pairs, arising in the radiolysis of glassy polar substances (aqueous solutions of alkali and alcohols) at 77°K was studied. The introduction of electron acceptors leads to a substantial increase (by ~70%) in the yield of separated ion pairs in comparison with the pure matrices. (auth)

21998 STUDY OF HYDROSTANNYLATION IN A γ-RADIATION FIELD. Lopatina, V. S.; Sheverdina, N. I.; Vainshtein, B. I.; Kocheshkov, K. A. Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 11, 2553-2555(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 11, 2641-2643(Nov 1974).

A study was made of the addition of triethyltin hydride to 1-heptene in a γ-irradiation field. The accumulation rate of the reaction product is proportional to the square root of the dose rate. The radiation-chemical yield decreases with increase in the dose rate. The effective activation energy of the process was determined. (auth)

21999 POLYESTER-BASED RADIATION HARDENING LACQUER BINDING AGENT. Burlant, W. J. (to Ford Motor Co.). Norwegian Patent 131511. 10 Feb 1967. 4p. (In Norwegian).

A procedure for producing a lacquer binding agent which can be hardened by electron irradiation with an energy of 120 to 500 KeV, and whose viscosity allows rapid application while giving a film thickness of 0.025 mm on a vertical surface, without dripping, is described. The binding agent consists mainly of a polyester resin with molecular weight between 2000 and 20,000 in a solvent containing 30 to 70% styrene and 70 to 30% methyl methacrylate. (NO)

22000 EFFECTS OF GAMMA IRRADIATION ON THE AQUEOUS VIOMYCIN SULPHATE SOLUTION. Bryl-Sandelewska, T.; Lugowska, U. E. Acta Pol. Pharm.; 31: No. 5, 627-633(1974). (In Polish).

Influence of radiation dose, antibiotic concentration, kind of gas and other additives on radiolysis of aqueous viomycin sulphate solutions was investigated. These factors have been shown to affect differently pH, contents of active and inactive forms of the antibiotic, and absorption at uv and in the visible region. Degree of the radiolytic degradation of viomycin sulphate has been shown to decrease on increasing its concentration. (auth)

22001 PARA- AND FERROELECTRIC PHASE EPR STUDY OF IRRADIATED KH_2AsO_4. Cevc, C.; Schara, M. (Univ. of Ljubljana, Yugoslavia). Phys. Status Solidi A.; 30: No. 1, 357-363(16 Jul 1975).

The AsO_4^{4-} center was used to characterize the polarized cluster fluctuations in the paraelectric phase. Lifetimes of 10^{-6}s at −50°C and a size of about 10^{-27}m^3 for the cluster have been determined. The KH_2AsO_4 radiation damage O_2^- and the distorted analog AsO_4^{4-} (II) of the well known AsO_4^{4-} center are described. (auth)

22002 BEHAVIOUR OF FREE RADICALS IN BITUMINOUS COAL. von Harpe, H.; Hemmer, E. A. Glueckauf-Forschungsh.; 35: No. 6, 240-245(Dec 1974). (In German).

ESR measurements were made on a coal with 28% volatile matter, and also on the coal after thermal treatment at temperatures of 100 to 250°C, on pyridine extract, on γ-irradiated coal and extract and on coal oxidized at temperatures between 120 and 250°C. All the ESR signals were asymmetric, showing a wide and a narrow line which might correspond to two different types of radical. An attempt was made to assign the two bands to two radical types. (auth)

22003 ABSORBED DOSE EFFECT ON RADIOLYSIS OF CYCLOHEXENE. Kovacs, A.; Cserep, G.; Foldiak, G. (Inst. of Isotopes, Budapest). Radiochem. Radioanal. Lett.; 22: No. 3, 221-229(15 Aug 1975).

The radiation chemical yield of hydrogen from irradiated cyclohexene is independent of the dose up to nearly 200 Mrad, whereas those of 1,3-butadiene, 1,3-cyclohexadiene, and trans-1,3-hexadiene decrease with increasing dose. This can be explained by radical scavenging as well as by charge and excitation transfer. Equations have been calculated for the description of dose dependence of the yields of these three conjugated dienes. The significant influence of conjugated dienes produced from monoalkenes on the radiolysis has been reconfirmed. (auth)

22004 FORMATION OF RADICAL CATIONS FROM 1,2- AND 1,4-DIMETHOXYBENZENE BY ELECTRON TRANSFER TO Tl^{2+} AND Ag^{2+} IN AQUEOUS SOLUTION. A Pulse Radiolysis and In Situ Radiolysis EPR Study. O'Neill, P.; Steeken, S.; Schulte-Frohlinde, D. (Max-Planck-Institut fuer Kohlenforschung, Muelheim, Ger.). Angew. Chem. Int. Ed. Engl.; 14: No. 6, 430-431 (Jun 1975).

Electron transfer from 1,2- and 1,4-dimethoxybenzene (1) and (2), respectively, to Tl^{2+} and Ag^{2+} to yield radical cations and Tl^+ and Ag^+ is reported. The radical cations were identified by in situ

radiolysis EPR. The optical absorption spectra and lifetimes of the radical cations and the rate constants were determined by electron pulse radiolysis. The aqueous solutions used were saturated with N_2O and contained 10^{-3} mol/l of Tl_2SO_4 and 10^{-4} mol/l of (1) or (2). The pH was adjusted with perchloric acid. The dependence of the radical cation concentration, as measured by pulse radiolysis, upon the pH value of the solution corresponds to that of the species Tl^{2+}. It is concluded that only Tl^{2+} reacts completely with (1) and (2) by electron transfer, in contrast to $[TlOH]^+$. The complex $[TlOH]^+$ reacts with (1) and (2) with about the same k values as Tl^{2+}. Thus the presence of (1) or (2) does not disturb the equilibrium between Tl^{2+} and $[TlOH]^+$. (JGB)

22005 GAMMA IRRADIATION OF CYCLIC COMPOUNDS. II. Irradiation of Myo-Inositol in Aqueous Solutions Under Nitrogen. Bancher, E.; Washuettle, J.; Schmidt, B.; Riederer, P.; Wurst, F. (Technische Hochschule, Vienna). J. Radioanal. Chem.; 25: No. 2, 227-231(1975). (In German).

Upon γ irradiation of a 1% myo-inositel solution under N_2 atmosphere, it was established that the oxidation results in a monoketone (myo-inose-2) and a desoxy derivative 1,3,5/2,4-cyclohexapentite (scyllo-quercite). A new polymer, which did not appear during irradiation under O_2 atmosphere, was also observed. (auth)

22006 RADIATION STABILITY OF CARBORANES IN WATER–NITROBENZENE SYSTEM. Rais, J.; Teply, J. (Nuclear Research Inst., Rez, Czechoslovakia). Radiochem. Radioanal. Lett.; 22: No. 2, 119-126(16 Jul 1975).

Radiation stability of polyhedral carborane anions in 0.5 mol/dm^3 HNO_3–nitrobenzene system irradiated with doses up to 50 Mrd was investigated. The decomposition of reagents by radiation was indicated by a decrease in the distribution ratio of Cs^+ and changes in absorption spectra. The carborane complexes show a considerable radiation stability in this medium within the studied dose region, the radiation yield of their decomposition amounts to 0.5 – 0.2 molec/100 eV. A remarkabe protective effect was observed on the addition of diisopropyl ether. (auth)

22007 RADIOLYSIS OF THE COMPLEX OXALATES IN AQUEOUS SOLUTIONS. V. On the Radiolysis Mechanism of Potassium Trisoxalatocobaltate in Aqueous Solution. Paun, J.; Memetea, T.; Stroe, E. (Univ. of Bucharest). Radiochem. Radioanal. Lett.; 22: No. 2, 101-109(16 Jul 1975).

From the study of the radiolysis of $Co(C_2O_4)_3^{3-}$ ion in aqueous solution at different experimental conditions the reduction by other species apart from hydrated electron and hydrogen atom is proposed. Evidence is also presented for the reduction of the complex ion by the radical-ions $CO_2^{\cdot-}$ and $C_2O_4^{\cdot-}$. (auth)

22008 ABSORPTION MEASUREMENTS ON INTERMEDIATES OF ACTIVE NITROGEN BY MEANS OF PULSE RADIOLYSIS. Dreyer, J. W. Bonn; Univ. Bonn. (1972). 125p. (In German). INIS.

Thesis.

After irradiating nitrogen (0.5–2,200 mm Hg) with a short pulse of energetic electrons (3 nsec, 600 keV, 10 Joule), some species of the active nitrogen were traced by means of kinetic spectroscopy in the spectral range of 200–900 nm. The electronic and electro-optical part of the measuring apparatus have been developed for this to such an extent that kinetic measurements can be carried out with a time and spectral resolution to 2 nsec or 0.01 nm, where the noise ratio remains better than 50. The formation and the reaction of the $N_2(A,v)$ states have been measured in pure nitrogen as well as in nitrogen/additional gas mixtures (C_2H_6, C_2H_4 and NO) with the help of the first positive system. The predominant reaction in pure nitrogen is the vibration–vibration (V–V) energy transfer from $N_2(A,v \geq 2)$ to $N_2(X, v = 0)$ with $\Delta v_A = 2$ and $\Delta v_X = 1$. (auth)

22009 RADIOLYSIS OF STARCH. A Contribution to Quantitative Determination of Several Radiolysis Products in Potato Starch and Wheat Flour. Scherz, H. (Bundesforschungsanstalt fuer Ernaehrung, Karlsruhe (F. R. Germany). Inst. fuer Strahlentechnologie). Staerke; 27: No. 2, 46-51(1975). (In German).

4 figs.; 5 tabs.; 13 refs. Separate print.

The amounts of desoxy-compounds formed, which produce malonic dialdehyde during HIO_4-oxydation, as well as that of ω-hydroxymaltol, have been determined in irradiated potato starch and irradiated wheat flour in dependence on irradiation doses. With pure potato starch, G values of 0.03 to 0.04 for water soluble desoxy-compounds and 0.02 for insoluble desoxy-compounds were obtained. G values of desoxy-compounds in an ethyl acetate-acetone-water extract (4 : 5 : 1 v/v) of irradiated potato starch and irradiated wheat flour showed a ratio of about 3 : 1. When aqueous potato starch sols are irradiated, desoxy-groups in the high-molecular starch molecule will also be found (in N_2O atmosphere: G values around 0.3). In non-irradiated materials traces of desoxy-compounds as well as ω-hydroxymaltol were found. (auth)

22010 HYDROGEN PEROXIDE DECOMPOSITION ON NICKEL OXIDE OF DIFFERENT ORIGIN AND THE INFLUENCE OF IR-RADIATION ON THIS PROCESS. Schwab, G. M.; Mucka, V. (Muenchen Univ. (F. R. Germany). Physikalisch-Chemisches Inst.). Z. Phys. Chem. (Frankfurt); 93: No. 1-6, 77-94(Nov 1974). (In German).

The kinetics of decomposition of hydrogen peroxide (1.2 M aqueous solution) and its dependence on previous irradiation of the catalyst were studied with nickel oxide of various origins. The reaction order is nearly the first on all samples and the catalytic activity of all samples (except NiO from oxalate) is proportional to the amount of chemisorbed oxygen. NiO from oxalate is 500 to 1,000 times more active. Here probably $Ni-Ni^{2+}$ groups act as active centers, whereas in other samples $Ni^{2+}-Ni^{3+}$ are active. Catalysts preirradiated with γ doses below 1.07×10^8 rad do not show changes of catalytic activity. Irradiation in a nuclear reactor produces increases of activity with catalysts only prepared from carbonate or nitrate. A maximum was found after preirradiation with a dose of 7.76×10^{17} cm^{-2} slow neutrons, 2.93×10^{17} cm^{-2} fast neutrons, and 2.88 rad γ rays. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 22011 and 23375.

22011 (COO-1760-8) CYCLOTRON AS AN INSTRUMENT FOR CHEMICAL RESEARCH. Technical Progress Report, During Twelve Months Ending May 31, 1975. (Washington Univ., St. Louis, Mo. (USA)). 15 Jul 1975. Contract E(11-1)-1760. 61p. Dep. NTIS $6.25.

Activities and accomplishments are reported in three sections: (1) Review of Cyclotron Laboratory Operations; (2) Radiochemical Studies of Nuclear Fission and Search for Element 118; and (3) Spectroscopy of Nuclear Systems. Included in the first section are operating schedules, a summary of actual use, non-operational activities, and a discussion of income and expenses. Radiochemical studies of nuclear fission include nuclear-charge distribution data, fractional-independent yields for technetium isotopes, and recoil from beta decay. The principle decay scheme studies reported are the decay of neutron deficient tin isotopes, the decay of short-lived palladium isotopes, and the structure of N equals 81 nuclei. Several experiments using in-beam gamma-ray spectroscopy are presented, including the investigations of ^{93}Mo, ^{107}In, and ^{196}Hg. (PMA)

22012 (ZFK-280) ANNUAL REPORT, 1974. Muenze, R. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jul 1974. 155p. (In German). Dep. NTIS (US Sales Only) $10.75.

The annual report consists of five sections: chemistry of nuclear fuels and nuclear reactors, research and production of isotopes, nuclear analytical chemistry, theoretical and fundamental research, and devices and methods. A list of publications and lectures is appended. Separate abstracts were prepared for each section. (JSR)

For abstracts of individual sections see: 21813, 22013–22015, and 22417.

22013 (ZFK-280, pp 1-34) CHEMISTRY OF NUCLEAR FUELS AND NUCLEAR REACTORS. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, Ger.). Jul 1974. (In German).

In annual report, 1974. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

In addition to brief abstracts of research already reported in the literature, research is reported on spectrophotometric determination of Pu, analysis of ^{148}Nd for the determination of the burn-up of nuclear fuels, precipitation of UO_2 from salt melts containing uranyl fluoride, production of compressed F_2 by liquefaction, determination of fluoride by means of a fluoride-sensitive electrode, fluoride determination in uranium oxides by pyrohydrolysis, corrosion of monel in HF–water vapor mixtures, thick Ni plating for production of corrosion resistant layers against F_2, preparation of large-grain mixtures from UO_2 powder, nuclide yield in an extended irradiation of ^{239}Pu in the Rossendorf research reactor, radioactive wastes from the aqueous reprocessing of spent fuel elements, radioiodine separation from the waste gas of nuclear installations, and inclusion of Kr in clathrates. (JSR)

22014 (ZFK-280, pp 35-57) RESEARCH AND PRODUCTION OF ISOTOPES. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, Ger.). Jul 1974. (In German).

In annual report, 1974. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

In addition to brief abstracts of research already reported in the literature, research is reported on release of ^{99}Mo from irradiated U_3O_8, oxidation state of ^{99m}Tc eluted from ^{99}Mo—^{99m}Tc generators, high purification of ^{99}Mo, radioactive purity and elution yield from ^{99m}Tc generators, installation for the preparation of sterile ^{99m}Tc generators, enzymatic radioiodine labelling of proteins and peptides, preparation of spherical HSA particles for liver scintigraphy and their labelling with ^{99m}Tc and ^{113m}In, chloride-iodide anion exchange in aqueous human serum albumin solutions, synthesis of labelled albumins and amino acids, metabolism of human serum albumin microspheres, synthesis of N-acetyl-1-^{14}C-imidazol, synthesis of adenin-8-T and guanosin-8-T, construction of a new isotope production facility, isotope production in 1973, and separation of human serum albumin. (JSR)

22015 (ZFK-280, pp 114) THEORETICAL AND FUNDAMENTAL RESEARCH. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, Ger.). Jul 1974. (In German).

In annual report, 1974. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

In addition to brief abstracts of research already reported in the literature, research is reported on complex formation of some lanthanides and actinides with acetate, Pu(VI)—citrate complex equilibrium in aqueous solution, general relation between the free standard enthalpy and entropy in compound formation in aqueous solution, effect of neutral salt addition on the deposition potential of Cd on Hg, structure and stability of neptunylate (V) modification of mean activity coefficients of Cd salts by foreign salt additions, conductivity of Li salts in organic-aqueous solutions, viscosity and density of LiCl and $LiClO_4$ in dimethyl sulfoxide–water mixtures with and without addition of HCl, complex formation of light rare earths with *o*-hydroxyisobutyric acid in water–dioxane mixtures, studies on dioxane–water mixtures by means of absorption spectra, calculation of radical production in aqueous systems of selected nuclides, design studies on fluidized beds, and potentiometric precipitation titration of adenine with ammoniacal silver nitrate solution. (JSR)

Hot-Atom Chemistry

22016 (NP–20444, pp 44) CHEMISTRY OF IODINE-126 IN 14 MEV NEUTRON IRRADIATED CRYSTALLINE POTASSIUM IODATE AND PERIODATE. Aditya, S.; Maity, H. P.; Bhattacharyya, S. N. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

22017 CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS IN SOLIDS. Maddock, A. G. (Cambridge Univ., Eng.). pp 273-327 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters, entitled: physical investigations; direct determination of the fragmentation energy; the n,γ reaction in oxyanions; n,γ effects in metal complexes; n,γ effects in complex halo anions; n,γ effects in organometallic compounds; n,γ effects in metal phthalocyanines; annealing and solin-state exchange; n,γ effects in double complexes; annealing kinetics and mechanism; effects of isomeric transitions; effects of β decay; nuclear reactions leading to very large recoil energies; processes in simple chlorides (phosphorus, sulphur); ion implantation; applications to the enrichment of radioactive products. (UK)

Properties of Radioactive Materials

Refer also to abstracts 21896, 21925, 21926, 21928, 22012, 22655, 22705, and 22891.

22018 (AED-CONF-75-080-004) INVESTIGATIONS ON THE DISSOCIATION OF ^{14}C-LABELED O-PHENYL CARBAMOYL BENZOHYDROXAMIC ACIDS. Zoerkendoerfer, E. 1975. 10p. (In German). INIS.

From meeting of lecturers in chemistry; Duesseldorf, F. R. Germany (7 Apr 1975).

2 tabs.; 2 refs. With abstract.

O-phenyl carbamoyl benzohydroxamic acid reacts upon heating with and without solvent with the dissociation of CO_2 to give N,N'-diphenyl carbamide. O-phenyl carbamoyl-(carbonyl-^{14}C) benzhydroxamic acid was converted into N,N'-diphenyl (carbonyl-^{14}C)carbamide and O-phenyl carbamoyl-(1-^{14}C)benzhydroxamic acid into N,N'-di(1-^{14}C)phenyl carbamide and relative mole activities of 7-82% or 13-98% were found depending on the reaction conditions. Ureas are obtained with high relative mole activities in the toluene/triethyl amine system and with low mole activities in the dioxane/water system. Dissociation mechanisms which explain the mixtures obtained are compared with literature data on the dissociation of O-carbamoyl hydroxamic acids. (auth)

22019 (BNWL-SA-5501) DEVELOPMENT OF DISPOSITION CRITERIA DEVIATION METHODOLOGY FOR COMMERCIAL FUEL CYCLE FACILITIES. Waite, D. A.; Jenkins, C. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 21p. Dep. NTIS $4.25.

Development and definition of acceptable criteria for release of nuclear sites and/or facilities under specified use restriction categories or disposition criteria are discussed. Previous reports have defined site and facility characteristics before major decontamination or decommissioning. With this background information, disposition criteria were developed to facilitate decision-making regarding disposition alternatives. To develop these disposition criteria, existing guidance was reviewed, philosophy and objectives were identified, and mechanisms were developed and applied to a generic mixed oxide fuel fabrication plant. (auth)

22020 (CONF-750913-4) STRUCTURE AND BONDING IN COMPOUNDS CONTAINING THE NpO_2^+ AND NpO_2^{2+} IONS. Musikas, C.; Burns, J. H. (Oak Ridge National Lab., Tenn. (USA)). 1975. 17p. Dep. NTIS $4.00.

From fourth international transplutonium elements symposium; Baden-Baden, F. R. Germany (13 Sep 1975).

Studies of oxo cations of Np(V) and Np(VI) were made on single crystals using X-ray diffraction and spectroscopic methods. Quantitative measurements of the geometry of the triatomic ion and its uranyl(VI) analog made it possible to assess the effects on bond lengths of the nature of equatorial secondary bonds, the change in valence from V to VI, and the actinide contraction. Absorption spectra showed marked changes in the solid state compared to the same ion in solution, especially anisotropy with crystal orientation (dichroism). The compounds analyzed were $Na_4NpO_2(O_2)_3 \cdot 9H_2O$, $Na_4UO_2(O_2)_3 \cdot 9H_2O$, $K_4NpO_2(CO_3)_3$, and $BaNpO_2(H_3C_2O_2)_3 \cdot 2H_2O$. All actinyl ions were found to be linear. The largest difference in M equals 0 bond lengths is between 1.776 in the compound having the relatively weak secondary linkage to carbonate, and 1.843 A in which the peroxide forms much stronger covalent bonds. Between compounds identical except for change of U to Np the M equals 0 bond length contracts by only about 0.01 A. However an elongation of about 0.11A is observed when neptunium(VI) is reduced to neptunium(V) without change in the equatorial ligand. (auth)

22021 (CONF-750913-8) SPECTROSCOPIC AND X-RAY DIFFRACTION STUDIES OF THE BROMIDES OF CALIFORNIUM-249 AND EINSTEINIUM-253. Young, J. P.; Haire, R. G.; Fellows, R. L.; Noe, M.; Peterson, J. R. (Oak Ridge National Lab., Tenn. (USA); Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1975. 7p. Dep. NTIS $4.00.

From 4th international transplutonium elements symposium; Baden-Baden, F.R. Germany (13 Sep 1975).

Results of the spectrophotometric and x-ray diffraction studies of the bromides of ^{249}Cf and ^{253}Es in the temperature range from 25 to 700°C are presented. In the reduction of $CfBr_3$ with H_2 three compounds $CfBr_3$, $CfBr_2$, and CfOBr were identified in the capillaries. The extent of the reduction of $CfBr_3$ is a function of both the temperature and the length of heating. It was impossible to prepare pure $CfBr_2$. The study of the Es bromides established the existence of $EsBr_3$, but attempts to prepare $EsBr_2$ have been unsuccessful. Pronounced spectral changes are noted after rapid cooling of $EsBr_3$ and related compounds from a temperature of 500 to 600°C indicating changes in the local environment of the Es cations. The emission spectra of Es bromides were obtained and indicate that there may be at least two different emission spectra, one from $EsBr_2$ and the other from an unidentified species. A large increase in the intensity of the emission band spectrum at 900 nm is seen as the temperature of $EsBr_3$ increases to temperatures about 325°; it disappears at about 450°C. Possible explanations for these phenomena are discussed. (JSR)

22022 (DP-MS-75-78) POTASSIUM BIS(CYCLOOCTATETRAENYL)AMERICIUM(III). Karraker, D. G. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Sep 1975. Contract AT(07-2)-1. 6p. (CONF-750913-7). Dep. NTIS $4.00.

From 4th international transplutonium elements symposium; Baden-Baden, F. R. Germany (13 Sep 1975).

Potassium bis(cyclooctatetraenyl)americium(III) was prepared by the reaction of potassium cyclooctatetraene ($K_2C_8H_8$) in tetrahydrofuran (THF) solution with $^{243}AmI_3$. Metal analysis agrees with the composition $KAm(COT)_2 \cdot 2THF$, X-ray powder diffraction patterns show it to be isostructural with the analogous Np^{3+} and Pu^{3+} compounds, and its absorption spectra has maxima characteristic of the Am^{3+} ion. $KAm(COT)_2 \cdot 2THF$ flames when exposed to air and is decomposed instantly by water. Attempts to reduce the com-

pound produced an unstable species, possibly a compound of Am^{2+}. (auth)

22023 (IEA-361) DETERMINATION OF THE DIFFUSION COEFFICIENTS OF URANYL NITRATE IN AQUEOUS AND ORGANIC MEDIA USING THE POROUS DIAPHRAGM METHOD. Chierice, G. O. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Nov 1974. 8p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

This work presents a study on the determination of uranyl nitrate diffusion coefficients in organic and aqueous media, using the porous diaphragm method, the simplest among the stationary methods. The diffusion coefficient is one of the parameters necessary for obtaining the extraction exponential coefficients, that are contained within the H. T. U. (height of transfer unity) calculation expression, when operating with continuous organic phase. The organic phase used was tri-n-butyl-phosphate (TBP) and varsol in 35% and 65% proportions. After each experiment in this system, the uranium content present in each compartment was spectrophotometrically determined and the quantities contained in the aqueous phases were determined by means of volumetric titration. It was found that the uranyl ion diffusion coefficient is two and one half times less in organic phase, this being atributed to the greater interactions of the uranyl ions in organic than in aqueous medium. (auth)

22024 (LA-UR-75-1364) BOND LENGTHS AND BOND STRENGTHS IN COMPOUNDS OF THE 5f ELEMENTS. Zachariasen, W. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 6p. (CONF-750913-6). Dep. NTIS $4.00.

From 4th international transplutonium elements symposium; Baden-Baden, F.R. Germany (13 Sep 1975).

The variation of bond length (D) with bond strength (S) in normal valence compounds of 3d, 4d, 5d-4f, and 6d-5f elements can be represented approximately as D(S) equals D(0.5) F(S), where D(0.5) is a characteristic constant for a given bond and F(S) an empirical function which is the same for all bonds. A bond strength S/sub ij/ equals S/sub ji/ is assigned to the bond between atoms i and j such that SIGMA/sub j/ S/sub ij/ equals v/sub i/ and SIGMA/sub i/ S/sub ij/ equals v/sub j/, where v/sub i/ and v/sub j/ are the normal valences of the two atoms. The function F(S) decreases monotonically with increasing S, and is normalized to unity at S equals 0.5, so that the constant D(0.5) has the physical meaning of being the bond length adjusted to S equals 0.5. The method described above was used to interpret and systematize the experimental results on bond lengths in oxides, halides, and oxyhalides of the 5f elements. (auth)

22025 (LA-UR-75-1402) HYDRATION ENERGIES AND SPECIFIC INFLUENCE OF OXO COMPLEXES AND HIGH COORDINATION NUMBERS ON THE PREDICTED CHEMISTRY OF SUPERHEAVY ELEMENTS. Jorgensen, C. K.; Penneman, R. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 6p. (CONF-750913-7). Dep. NTIS $4.00.

From fourth international transplutonium elements symposium; Baden-Baden, F. R. Germany (13 Sep 1975).

On the basis of an analysis of the known ionization energies of gaseous ions and aqua ions of the 3d, 4f, and 6d transition groups and the radius effects, the chemistry of the superheavy elements is predicted. The formation of aqua ion and oxo complexes in the elements with Z below 121 is considered. It is probable that the series from 123 to 140 constitute a close analogy to the lanthanides with Th-like chemistry. Above Z equals 140 the elements will probably displace a transition group behavior. A brief comment is made on the analytical aspects to be expected. (JSR)

22026 (TID-26506) KINETICS OF THE OXIDATION-REDUCTION REACTIONS OF URANIUM, NEPTUNIUM, PLUTONIUM, AND AMERICIUM IN AQUEOUS SOLUTIONS. Newton, T. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. 140p. Dep. NTIS $5.45.

This is a review with about 250 references. Data for 240 reactions are cataloged and quantitative activation parameters are tabulated for 79 of these. Some empirical correlations are given. Twelve typical reactions are discussed in detail, along with the effects of self-irradiation and ionic strength. (auth)

22027 TRITIUM TESTING OF IMMUNOGLOBULIN WITH IODOACETIC ACID. Parkinson, A. J.; Kalmakoff, J. (Ottago Univ., Dunedin, New Zealand). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 367-371(Jun 1975).

The labeling of immunoglobulin with iodoacetic acid-2-^{3}H has been found to be markedly dependent on temperature, pH, and time. The optimum labeling conditions combining maximum specific radioactivity with minimum alteration to the antigen binding ability of the labeled immunoglobulin were 70°C and pH 9.8 for 30 min. This resulted in labeled immunoglobulin whose specific radioactivity ranged between 2700 and 3400 dpm/μg and 45% of which could bind to the homologous antigen. Bands obtained by the SDS polyacrylamide gel electrophoresis of the labeled preparation were strictly comparable to those of unlabeled immunoglobulin and the protein specific radioactivity was found to be largely confined to polypeptides of molecular weight greater than 1.6×10^5 daltons. (auth)

22028 SOME OBSERVATIONS ON THE CHEMICAL STATE OF TECHNETIUM IN LABELLED COMPOUNDS OF MEDICINAL IMPORTANCE. Narasimhan, D. V. S.; Mani, R. S. (Bhabha Atomic Research Centre, Bombay (India). Isotope Div.). pp 47-54 of Proceedings of the Chemistry Symposium, Aligarh, December 21-23 1972. Vol. I. Radioisotope Techniques for Chemical and Biomedical Applications, Nuclear and Radio Chemistry, and Radiation Chemistry. Bombay; Department of Atomic Energy (1974).

From chemistry symposium; Aligarh, India (21 Dec 1972).

The radiochemical purity of technetium-99m labelled human serum albumin prepared by two procedures have been evaluated. It has been found that in addition to the labelled albumin, reduced technetium species which closely follow the labelled albumin in analytical separations based on paper chromatography, TCA precipitation, etc. are also present in the preparations. Detailed studies of the factors governing the formation of technetium sulfur colloid indicate that unless the experimental conditions are carefully controlled, the labelled product obtained will contain radiochemical impurities the nature of which has not been clearly defined. (auth)

22029 BOVINE FIBRINOGEN MODIFIED WITH ^{3}H-ACETIC ANHYDRIDE (^{3}H-AcOAc). Wegrzynowicz, Z.; Kloczewiak, M.; Kopec, M. (Inst. of Nuclear Research, Warsaw). J. Lab. Clin. Med.; 86: No. 2, 360-368(Aug 1975).

The method is described for acetylation of bovine fibrinogen with ^{3}H-acetic anhydride (^{3}H-AcOAc). Preparations acetylated at pH 7.8 with 10 to 40 molar excess of ^{3}H-AcOAc were found to contain 8 to 13 moles of acetyl residues per mole of fibrinogen. The content of clottable protein and ultraviolet (uv) spectra were unchanged as compared with control unlabeled preparations. The rate of clotting with thrombin was only slightly affected. The investigations on distribution of ^{3}H-acetyl groups in products of proteolysis of acetylated fibrinogen by thrombin demonstrated a preferential acetylation of fibrinopeptide A and absence of radioactive tracer in fibrinopeptide B. Incorporation of the label into fibrinopeptide A opens the possibility for application of fibrinogen labeled with ^{3}H-AcOAc as a convenient substrate for selective investigations on the enzymatic phase of clotting. (auth)

22030 LABELING OF ERYTHROCYTES WITH ^{103}Ru-RUTHENIUM RED. Anghileri, L. J. (Univ., Essen). J. Nucl. Med.; 16: No. 8, 795-797(Aug 1975).

The preparation of ^{103}Ru-ruthenium red and its use in the labeling of erythrocytes is described. Since in vivo and electrophoretic studies indicate that the tag is firmly bound to the cell, this technique appears to be very convenient for spleen scintigraphy and for the study of the in vivo fate of tagged cells. (auth)

22031 METHOD FOR THE PREPARATION AND QUALITY CONTROL OF ^{68}Ga RADIOPHARMACEUTICALS. Hnatowich, D. J. (Massachusetts General Hospital, Boston). J. Nucl. Med.; 16: No. 8, 764-768(Aug 1975).

Gallium-68 (T/sub 1/2/ 68 min) is a convenient label for radiopharmaceuticals designed for use with positron detection devices; the radionuclide is a generator product obtained from its parent ^{68}Ge (T/sub 1/2/ 287 days). The labeling procedure itself is simple since gallium forms complexes without the use of reducing agents. However, ^{68}Ga is present in the generator eluant as the gallium-EDTA chelate and must be separated from EDTA prior to its use as a label. A rapid and efficient method for achieving this separation and for preparing ^{68}Ga-labeled compounds for human use has been developed. Paper chromatography is employed to determine the amount of each major gallium species present in preparations of two gallium complexes; ^{68}Ga-adenosine triphosphate and ^{68}Ga-citrate. (auth)

22032 COMPLEX FORMATION OF URANYL ACETATE WITH TETRACYCLINE AND ITS UTILIZATION FOR THEIR MICRODETERMINATION. Mahgoub, A. E. (Univ. of Cairo); Khairy, E. M.; Kasem, A. J. Pharm. Sci.; 63: No. 9, 1451-1455(Sep 1974).

Conductometric and spectrophotometric (covering the visible, uv, and ir ranges) studies as well as microanalyses of uranyl complexes with tetracycline revealed the existence of the 1:1 complex species. The mean stability constant of the 1:1 complex, as determined spectrophotometrically, amounted to 1.2×10^5. This finding permits the use of the procedure for the microdetermination of tetracycline using UO_2^{+2} ion or vice versa. (auth)

22033 REACTION BETWEEN URANIUM(IV) AND OXYGEN. Koltunov, V. S.; Elovskikh, N. N.; Pankratova, Z. D.; Reshchikov, B. P. Russ. J. Phys. Chem.; 48: No. 11, 1614-1616(Nov 1974). Translated from Zh. Fiz. Khim.; 48: No. 11, 2739-2741(Nov 1974).

The kinetics of the oxidation of uranium(IV) by molecular oxygen was studied in aqueous perchloric acid at ionic strength 4. At low uranium(IV) concentrations the reaction is of the first order with respect to both reactants and of the second order with respect to hydrogen ions. At high uranium(IV) concentrations the order is still unity with respect to oxygen, but zero with respect to uranium(IV), and dependent on the concentration of hydrogen ions with respect to them. Activation energies were determined in both cases. (auth)

22034 SIMPLIFIED METHOD FOR THE PREPARATION OF ^{131}I-IODOTHALAMATE. Sierra Ordonez, P.; Alvarez Cervera, J. Prensa Med. Mex.; 39: No. 5-6, 259-261(1974). (In Spanish).

A simplified method for the preparation of ^{131}I-iodothalamate, based on the isotopic exchange between labelled iodide and stable iodothalamate during the sterilization of the reagents in an autoclave for 20 minutes, is described. The radiochemical yield obtained is 97%. The effects of pH of the solution and the length of heating were determined. The methods of quality control are described. Labelled iodothalamate, prepared in this manner, gives results no different from those obtained with the compound prepared by the usual procedure. (JSR)

22035 SYNTHESIS OF N^4-ETHYL-^{14}C-L-ASPARAGINE. Dineen, R. W.; Gray, D. O. (Westfield Coll., London). Radiochem. Radioanal. Lett.; 22: No. 3, 205-207(15 Aug 1975).

N^4-ethyl-^{14}C-asparagine was synthesised from ^{14}C-aspartic acid via the β-ethyl-aspartate route. Yields averaged 53% and the radiochemical recovery was 80-90%. The stability of the product towards chromatographic solvents and ion exchange resins is discussed. (auth)

22036 PREPARATION AND APPLICATION OF RADIOIODINATED PROTEINS. Franek, M.; Hampl, J.; Prochazka, Z.; Rodak, L.; Hruska, K. (Veterinary Research Inst., Brno). Chem. Listy; 69: No. 7, 730-751(Jul 1975). (In Czech).

Various techniques for the labelling of proteins and peptides with radioactive iodine are reviewed. Particular attention is directed to the mechanism of iodination of tyrosine used as a model substance for radioiodination of proteins. Consideration is given particularly to recent techniques enabling a high specific radioactivity without side effects on the protein molecule and to those factors that affect the rate of iodination and its character (buffers, polarity of the reaction environment, molecule type, etc.). Evidence is presented to show the suitability of radioiodinated proteins in studies of protein metabolism and in radioimmunoanalytical determination of substances of both protein and non-protein nature. The possibility of further application of radioiodinated protein is discussed. (auth)

22037 SOLUBILITY AND ABSORPTION SPECTRA OF A CARBONATE COMPLEX OF PENTAVALENT NEPTUNIUM. Ueno, K.; Saito, A. (Japan Atomic Energy Research Inst., Tokai). Radiochem. Radioanal. Lett.; 22: No. 2, 127-133(16 Jul 1975).

Pentavalent neptunium carbonate, $NaNpO_2CO_3$, was prepared and its solubility in sodium carbonate solutions of various concentrations was determined. Absorption spectra of Np(V) in sodium carbonate solution were obtained in the visible and near infrared region. The spectrum showed peaks at 700, 800 and 970 nm. The absorbance at each peak was proportional to the Np(V) concentration. (auth)

22038 STUDY OF THE DIFFUSION OF ^{220}Rn IN MAGNESIA DURING THERMAL TREATMENT. Quet, C.; Bussiere, P. (CNRS, Villeurbanne, France). Radiochem. Radioanal. Lett.; 22: No. 2, 91-99(16 Jul 1975). (In French).

The emanating power of divided magnesia labelled with ^{228}Th by means of coprecipitation depends on temperature and texture of the solid, particularly on its specific surface area. The apparent activation energy of 32 kcal/mole for the diffusion of ^{220}Rn in a magnesia the specific surface area of which is 40 m^2/g and in the temperature range 530-1040°C is valid either with a mechanism of grain boundary diffusion or interstitial diffusion. (auth)

22039 SELF-DIFFUSION OF RADIONUCLIDES IN ETHANOL MEDIUM. Kepak, F.; Kriva, J. (Nuclear Research Inst., Rez, Czechoslovakia). Radiochem. Radioanal. Lett.; 22: No. 2, 141-145(16 Jul 1975).

Self-diffusion of radionuclides ^{106}Ru(IV), ^{106}RuNO(III), ^{147}Pm(III), ^{85}Sr(II), ^{54}Mn(IV) and ^{131}I$^-$ in 95% ethanol was studied. The values of self-diffusion coefficients as measured in an alkaline medium are lower than those for an acidic one. In an acidic medium the formation of ion pairs may take place while in an alkaline one colloidal hydroxides are being formed. (auth)

22040 ABSORPTION AND DISTRIBUTION EQUILIBRIUM OF TRITIUM ON PALLADIUM. Sicking, G. (Muenster Univ. (F. R. Germany). Inst. fuer Physikalische Chemie). Z. Phys. Chem. (Frankfurt); 93: No. 1-6, 53-64(Nov 1974). (In German).

4 figs.; 18 refs.

Measurements of the equilibrium distribution of tritium between hydrogen gas and Pd-hydride are reported. In the temperature region from -34 to +83°C the equilibrium separation factor follows the equation $\ln \alpha_{TH} = 636 \text{ cal mol}^{-1}/RT - 0.075$. Proceeding from the model for the hydrogen solubility as developed and tested experimentally in the palladium-hydrogen system, the decomposition pressure of pure β Pd-tritide is calculated from separation factor measurements. The vibration frequency of the tritons within the Pd lattice is estimated. (auth)

22041 K-Ar AGE DETERMINATIONS ON VOLCANICS WITH KNOWN PALEOMAGNETIC FIELD PARAMETERS. I. Oberpfalz and Oberfranken. Todt, W.; Lippolt, H. J. (Heidelberg Univ. (F. R. Germany). Lab. fuer Geochronologie). J. Geophys.; 41: No. 1, 43-61(1975). (In German).

Potassium-argon age determinations on 18 basaltic rocks from Oberpfalz and Oberfranken (Germany) and on a lava from western Bohemia were made. The ages cover the interval from 24 to 19 m.y., which corresponds to Aquitanian-Helvetian times. The basalt from Steinwitzhuegel and the lava from Kammerbuehl are exceptions (29 m.y., Upper Oligocene; <2 m.y., Pleistocene, respectively). The alleged occurrence of Pliocene volcanics in this area is thus excluded. The coal deposits of Klausen considered to be slightly older than this volcanism are consequently of Lower Miocene age. These age determinations together with paleomagnetic data taken from the literature date two reversals of the terrestrial magnetic field: one from reverse to normal at 23.0 ± 1.4 m.y., the other from normal to reverse at 20.7 ± 1.0 m.y. ago. (auth)

22042 LARGE METAL ION-CENTERED TEMPLATE REACTIONS. A Uranyl Complex of Cyclopentakis(2-Iminoisoindoline). Day, V. W.; Marks, T. J.; Wachter, W. A. (Northwestern Univ., Evanston, IL). J. Am. Chem. Soc.; 97: No. 16, 4519-4527(6 Aug 1975).

The reaction of o-dicyanobenzene with anhydrous uranyl chloride does not yield a cyclic, four-subunit phthalocyanine complex. Rather, it yields an expanded, cyclic five-subunit pentakis (2-iminoisoindoline) complex--a "superphthalocyanine." Dioxocyclopentakis(2-iminoisoindoline)uranium(VI), $UO_2(N_2C_8H_4)_5$, crystallizes in the monoclinic space group, P2/sub 1/c/, with a equals 8.210 (3) A, b equals 21.667 (7) A, c equals 18.462 (5) A, beta equals 103.16 (2)^0, and Z equals 4 (rho/sub calcd/ equals 1.891, rho/sub obsd/ equals 1.882 g/cm^3). Intensity measurements were made for 9564 independent reflections having 2 theta/sub Mo K anti alpha/ less than 60.4^0 at 20 +- 1^0 with Nb-filtered Mo K anti alpha radiation on a Syntex P/sub anti 1/ autodiffractometer. The structure was solved using the heavy atom technique. Cycles of anisotropic full-matrix least-squares refinement have given a final value of 0.054 for the conventional unweighted residual, R, for 4709 independent reflections having I greater than 3 sigma(I). The coordination geometry of the uranium atom approximates an idealized compressed pentagonal bipyramid. The two axial ligands are oxygen atoms with an average U-O bond length of 1.744 (8) A. The equatorial coordination is by five nitrogen atoms (the average U-N bond length is 2.524 (9) A) of the 20-atom "inner" ring of the 50-atom (excluding hydrogens) macrocycle. The cyclopentakis(2-iminoisoindoline) ligand is severely and irregularly distorted from planarity, presumably as a consequence of appreciable steric strain within the macrocycle. (auth)

22043 DECAY SYNTHESIS OF MULTITRITIATED COMPOUNDS USING CT_4 AS A NATURAL GENERATOR OF CT_3^+ CATIONS. Cacace, F. (Univ., Rome); Ciranni, G.; Schueller, M. J. Am. Chem. Soc.; 97: No. 16, 4747-4748(6 Aug 1975).

A report is given on a new synthetic approach to the preparation of multitritiated compounds, in particular those containing the -CT_3 group, based on the spontaneous beta$^-$ decay of CT_4, which makes the compound a natural generator of fully tritiated methyl cations. The method is illustrated by the preparation of tritiated methanol, ethyl bromide, and methyl bromide. (JGB)

22044 STRUCTURE OF TRIS(CYCLOPENTADIENYL)-FLUOROURANIUM(IV), $(C_5H_5)_3UF$. Ryan, R. R. (Los Alamos Scientific Lab., NM); Penneman, R. A.; Kanellakopulos, B. J. Am. Chem. Soc.; 97: No. 15, 4258-4260(23 Jul 1975).

The single-crystal x-ray structure of tris(cyclopentadienyl)-fluorouranium(IV), $(C_5H_5)_3UF$, was determined from three-

dimensional x-ray diffraction data collected by counter methods. The structure is rhombohedral with hexagonal dimensions a equals 13,698 (4) and c equals 5,980 (2) A, and contains Cp_3UF monomers having C/sub 3 nu/ symmetry. Thr uranium and fluorine atoms lie on the crystallographic threefold axis. Two uranium atoms are separated by the length of the c axis (5.98 A) with a fluorine atom located very asymmetrically between them, at the short U–F bond distance of 2.11 A and the intermolecular F–U distance of 3.87 A. The three symmetry-equivalent cyclopentadienyl rings are disordered across mirror planes and comprise, with the fluorine atom, a flattened tetrahedral arrangement with a F–U–Cp centroid angle of 99.7° and a centroid–U–centroid angle of 117.2°. Suspected dimer formation via uranium–fluorine–uranium bridging was not confirmed. However, the Cp rings are tipped toward the fluorine in the adjacent molecule at a distance appropriate for hydrogen bonding. The refinement model included hydrogens. The average C–C and U–C distances are 1.41 and 2.74 A, respectively; the U–Cp (centroid) distance is 2.46 A. (auth)

Radioactive Waste Treatment

Refer also to abstracts 22275, 22436, 22455, 22961, 22962, and 22968.

22045 (ARH-SA-239) GLASS FORMS FOR ALPHA WASTE MANAGEMENT. Kupfer, M. J.; Schulz, W. W.; Hobbick, C. W.; Mendel, J. E. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jul 1975. Contract E(45-1)-2130. 32p. (CONF-750902-6). Dep. NTIS $4.75.

From 80th national meeting of the American Institute of Chemical Engineers; Boston, Massachusetts, USA (7 Sep 1975).

Laboratory-scale amounts of various alpha wastes (e.g., plutonium-contaminated soil, incinerator ash, pyrolysis-process residues, etc.) was successfully converted to immobile silicate glasses. The preparation and properties of these glasses were studied. Such glasses appear to be suitable vehicles for immobilization and densification of residues generated in volume reduction of both U. S. Energy Research and Development Administration and commercially generated plutonium-bearing wastes. (auth)

22046 (ARH-ST-110C) WASTE MANAGEMENT AND TRANSPORTATION TECHNOLOGY DEVELOPMENT. Quarterly Report, January 1975–March 1975. Kupfer, M. J.; Van Slyke, W. J. (eds.). (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2130. 149p. Dep. NTIS $5.75.

Progress is reported in support of management of Hanford high-level wastes. The work reported here was performed during the period January through March 1975. The specific topics discussed are grouped into the subject areas of: salt cake retrieval, tank integrity; storage system improvements; waste immobilization; and preparation of failed, contaminated equipment for disposition. (auth)

22047 (BNWL-1908) RESEARCH AND DEVELOPMENT ACTIVITIES WASTE FIXATION PROGRAM. Quarterly Progress Report, January–March 1975. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-1830. 78p. Dep. NTIS $7.60.

The status of the following programs is reported: commercial waste fixation, waste form characterization, alternative waste fixation processes, and systems evaluation. Four engineering-scale in-can melting tests were conducted. The joule-heated ceramic melter has been in continuous operation for 70 days. The fluidized bed calciner was successfully operated during the last report period. Two new waste compositions were defined representing typical combinations of ILW with the reference AGNS HLW. Laboratory-scale melts were prepared to determine the characteristics of zinc borosilicate glass containing AGNS-type waste aimed toward achieving the maximum fission product loading in glasses containing HLW, combined HLW-ILW, and HLW-ILW plus iron. Experiments were conducted to observe the effect of solidified waste temperature on the stored energy behavior. Sintered pellets of a calcine and frit mixture were formed, characterized, and coated. (LK)

22048 (DP-1388) REMOVAL OF CESIUM FROM SAVANNAH RIVER PLANT WASTE SUPERNATE. Wiley, J. R.; Wallace, R. M. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jul 1975. Contract AT(07-2)-1. 19p. Dep. NTIS $4.00.

A process for separation and concentration of ^{137}Cs from Savannah River Plant waste supernate by using Duolite ARC-359 cation exchange resin was demonstrated with both synthetic and actual wastes. Tracer-level studies showed that Duolite resin efficiently sorbed cesium from a solution with composition expected for the plant process and that the resin could be cycled (load-elute-regenerate) repeatedly without damage. In column tests using actual waste supernates, greater than 99.99 percent of the ^{137}Cs was removed. Column throughput was correlated with feed composition by an empirical model. ^{137}Cs, eluted from the Duolite columns, was sorbed on zeolite for final solidification in concrete or glass. The overall volume reduction factor from cesium-salt solution to cesium-zeolite product is about 1400. Linde AW-500 zeolite sorbed cesium directly from waste salt solutions. Direct sorption is not recommended because 40 times more cesium-zeolite would be produced than by the Duolite process. (auth)

22049 (DP-1389) EVALUATION OF MINERALIZATION PROCESSES FOR SRP WASTES. Thompson, G. H. (Savannah River Ecology Lab., Aiken, S. C. (USA)). Jul 1975. 19p. Dep. NTIS $4.00.

High level radioactive wastes at the Savannah River Plant (SRP) consist of an insoluble sludge containing most of the actinides and fission products except cesium, and of a supernate (or soluble salt) containing most of the cesium. One option for long term management of these wastes is separation of the sludge and the cesium from a relatively nonradioactive residue followed by solidification and storage. Mineralization or a possible method of solidification were investigated. The study demonstrates the fixation of cesium in zeolite and aluminosilicate minerals and sludge reactions with sodium hydroxide and silica gel. Results of the study show that cesium removed from waste supernate can be fixed in zeolite; cesium leachability was approximately 4×10^{-8} g/(cm^2-day). Sodalite and cancrinite can be prepared by reacting alkaline cesium-containing waste with kaolinite. Volume increases were up to 285 times that of the zeolite product, and leachabilities were at least 10^4 times that of the zeolite product. Leachabilities were not improved by firing sodalite and cancrinite at 1000°C to form carnegieite and nepheline. Pollucite was produced by reaction of cesium with bentonite and kaolinite. However, not all the cesium reacted, and the product is a powder. Gamma doses of 10^{10} rads did not affect the cesium leachabilities or product volumes of the minerals. Simulated sludge is solidified, not mineralized, by reaction with NaOH and silica gel. The product is a hard, friable monolith occupying 2 to 5 times the original sludge volumes; preliminary strontium leachabilities were 5×10^{-7} g/(cm^2-day). (auth)

22050 (KFK-2126) DECONTAMINATION SERVICES: ANNUAL REPORT, 1973. Krause, H.; Rudolph, G. (comps.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Dekontaminationsbetriebe). May 1975. 149p. (In German). Dep. NTIS (US Sales Only) $10.50.

The work performed by the Decontamination Service includes laboratory studies on waste processing, development studies on decontamination of facilities, licensing operations, studies on storage of radioactive wastes, and the decontamination of liquid wastes. The radiation stability of bitumen–sodium nitrate mixtures was proved. In the planning of a facility for the destruction of the HNO_3 in radioactive waste solutions, intensive corrosion studies were initiated. Laboratory tests on the vitrification of high-level fission products were made. Solidification of fission products by means of a thermite reaction was studied for optimization of the reaction mixture and determination of the physical and chemical properties of the product. Methods were developed for the decontamination of primary loops in pressurized water reactors. Behavior of transuranium elements in soils and geological formations was studied. Storage of medium and low level wastes in the Asse salt mine was continued. Individual disposable shielded concrete casks were developed for the transport of waste drums. The decontamination of radioactive liquid wastes was complicated by the large increase in the amount of medium-level waste processed and by the processing of both organic and aqueous solutions. (JSR)

22051 RECOVERY OF FISSION PRODUCTS FROM ACIDIC WASTE SOLUTIONS THEREOF. Carlin, W. W.; Darlington, W. B.; Dubois, D. W. (to PPG Industries, Inc.). US Patent 3,891,741. 24 Jun 1975. Filed date 24 Nov 1972. 22p.

Fission products, e.g., palladium, ruthenium and technetium, are removed from aqueous, acidic waste solutions thereof. The acidic waste solution is electrolyzed in an electrolytic cell under controlled cathodic potential conditions and technetium, ruthenium, palladium and rhodium are deposited on the cathode. Metal deposit is removed from the cathode and dissolved in acid. Acid insoluble rhodium metal is recovered, dissolved by alkali metal bisulfate fusion and purified by electrolysis. In one embodiment, the solution formed by acid dissolution of the cathode metal deposit is treated with a strong oxidizing agent and distilled to separate technetium and ruthenium (as a distillate) from palladium. Technetium is separated from ruthenium by organic solvent extraction and then recovered, e.g., as an ammonium salt. Ruthenium is disposed of as waste by-product. Palladium is recovered by electrolysis of an acid solution thereof under controlled cathodic

potential conditions. Further embodiments wherein alternate metal recovery sequences are used are described. (auth)

22052 EMBEDDING WASTES FROM A LIGHT-WATER REACTOR IN THERMOSETTING RESINS. Cuaz, D.; Limongi, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service de Protection et des Etudes d'Environnement); Traxler (Groupement pour les Activites Atomiques et Avancees (GAAA), 92 - Le Plessis-Robinson (France)). pp 243-244 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The treatment of liquid effluents from light-water reactors consists of filtration, demineralization, and/or evaporation. Every operation generates radioactive wastes that need to be turned into solid wastes containing no free water, and need to be given safe embedding for transport and long-term storage. A new solidification process has been developed at the CEA. The process consists of embedding the wastes in polyester. The embedding material is a thermosetting resin, e.g., a solution of maleophthalate of propylene glycol in styrene. Polymerization is started by adding a catalyst and is favored by an accelerator. The operation is quite simple and needs neither heating equipment nor any of special design. (FR)

22053 NEW METHOD FOR THE FIXATION OF HIGH LEVEL RADIOACTIVE WASTES. Heimerl, W. (Gelsenberg A. G., Essen (F. R. Germany)). pp 249-252 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

A process for the solidification of high level radioactive waste solutions was developed. The process, called Pamela (phosphate glass solidification and metal incorporation of high level liquid active wastes) includes the following steps: concentration and denitration of the waste solutions in presence of phosphoric acid (reductant: formaldehyde); vitrification of the slurry produced (temperature 1000°C—product: granulated phosphate glass); off-gas cleaning and recovery of concentrated nitric acid; incorporation of the glass granules into a suitable metal matrix. The problems and advantages of the Pamela process are discussed. The flowsheet and state of development of the work are given. (FR)

22054 INTERACTION BETWEEN PROCESSING METHODS AND RADIOACTIVE WASTE BURIAL SITES. Sousselier, Y. (CEA Direction des Productions, 92 - Chatillon (France). Sous-Direction du Plutonium). pp 254-255 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The interacting factors between the processing methods and burial sites are considered. They are: leaching rate, part played by the packaging material, and effects of the storage site (shallow and deep levels). (FR)

22055 ADSORPTION OF FISSION PRODUCTS FROM AQUEOUS SOLUTIONS BY PRETREATED STRAW. Dai, M. H.; Wu, S. C. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Radiochem. Radioanal. Lett.; 22: No. 2, 135-139(16 Jul 1975).

Among the different chemical pretreatments of different kinds of natural celluloses, the cheap rice straw pretreated with concentrated nitric acid has shown that it is an excellent adsorbent for several high fission yield radioactive ions with long half-lives. The adsorption capacity of this adsorbent as a function of acidity has been studied, it is interesting to point out that the maximum adsorption capacity occurred at an acidity of 2N. Its adsorbability decreases with increasing temperature, and the radiation effect on adsorbability has also been studied. (auth)

Radioisotope Production

22056 (JUL-11(Bd.2), pp 3-18) DETERMINATION OF THE FORMATION RATE AND THE PURITY OF TRANSURANIUM ELEMENTS. Eberle, S. H.; Robel, W. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

7 figs.; 3 tabs.; 14 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. II. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

The transuranium nuclides Np-237, Am-241, Am-243, and Cm-244 are formed in large amounts in the nuclear reactor and can be isolated from the waste of nuclear fuel reprocessing. Their use as highly valuable source of energy or radiation cannot, however, be covered on a long-term basis by the reprocessing waste alone, so that a directed synthesis of especially the neutron reactions or resulting products to be obtained from the above nuclides must be considered. Thus the microscopic neutron capture cross-sections of Np-237, Am-241, Am-243, Cf-252 and Es-253 were determined and the yield of the nuclides produced, Np-238, Cm-242, Cm-244, Es-253, Fm-254 (the last four are β-transition products of the first produced Am-242, Am-244, Cf-253 and Es-254), were determined by gamma and alpha spectroscopy. The presently important Pu-238 can be obtained by irradiation of Np-237 as well as of Am-241. Its use as a cardiac pacemaker requires extreme purity. Special processes have been worked out to test the purity. Amongst these are the determination of the Pu-236 content, that of the neutron emission rate and that of the O-18 content and measures for the improvement of the degree of purity. (GE)

22057 (NP-20507, pp 6-8) RAPID SEPARATION OF NEUTRON-RICH Rh ISOTOPES FROM THEIR Ru PRECURSORS. Franz, G. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

22058 (NP-20507, pp 9-13) USE OF ION EXCHANGERS FOR THE RAPID SEPARATION OF SHORT-LIVED RADIONUCLIDES ON RESINS FROM FLOWING SOLUTIONS. Seyb, K. E. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

22059 REACTOR PRODUCED ^{202}Tl: DETERMINATION OF HALF-LIFE AND GAMMA ENERGIES. Cohen, I. M.; Korob, R. O.; Baro, G. B. (Comision Nacional de Energia Atomica, Buenos Aires). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 403-405(Jun 1975).

The production of ^{202}Tl in a nuclear reactor is discussed. The experimental method followed for the determination of the half-life and the γ energies is described. The following data were obtained: half-life, (12.23 ± 0.02) days; energies, (439.56 ± 0.01) keV and (520.13 ± 0.07) keV. (auth)

22060 ADSORPTION OF ^{59}Fe ON BASIC FERRIC ACETATE PRECIPITATES. Kambara, T.; Hasegawa, K.; Usuda, S.; Noguchi, I.; Takeuchi, Y. (Shizuoka Univ., Japan). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 373-375(Jun 1975).

Adsorption of ^{59}Fe on ferric acetate precipitates was studied in acetate buffer solutions in order to separate radioactive iron nuclides from other radionuclides such as chromium, manganese, cobalt and zinc. Effects of pH, buffer concentrations, amounts of precipitates, agitation times and specific activities on the ^{59}Fe adsorption were investigated. The adsorption mechanism is considered to be due to heterogeneous isotopic exchange between ferric ion in buffer solutions and acetate precipitates. The adsorption procedure might be useful for rapid and simple radiochemical separation of iron nuclides in water. (auth)

22061 PRODUCTION OF ^{67}Ga BY DEUTERON IRRADIATION OF ZINC. Vlatkovic, M.; Paic, G.; Kaucic, S.; Vekic, B. (Institut Rudjer Boskovic, Zagreb). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 377-379(Jun 1975).

The production of ^{67}Ga obtained by irradiating natural zinc in the internal deuteron beam of a classical cyclotron is presented. The radiochemical separation was performed by modified extraction with methyl isobutyl ketone from the solution of acids of ionic strength 5. The yield of ^{67}Ga was measured and compared with existing data. The suitability of the deuteron beam for production of ^{67}Ga is discussed on the basis of yield figures. (auth)

22062 ELUTING DEVICE FOR NUCLIDE GENERATORS. Strecker, H.; Tetzlaff, K. H. (to Hoechst Aktiengesellschaft). US Patent 3,898,044. 5 Aug 1975. Priority date 26 Jul 1972, F. R. Germany. 6p.

Device for eluting nuclide generators comprising a nuclide generator, conveying means, container for eluting agent, and eluate container is described. The container for the eluting agent, the eluate container and the conveying means are connected with the nuclide generator by conduits, the conveying means are mounted between the container for the eluting agent and the eluate container and the conveying means comprise a control mechanism, which permits to convey freely chosen amounts of eluate into the eluate container. (Official Gazette)

22063 INFLUENCE OF ZIRCONIUM IONS ON THE UPTAKE OF CARRIER-FREE ANTIMONY(III)(^{125}Sb) BY VARIOUS SOR-

BENTS. Friedmann, C.; Schoenfeld, T. (Univ., Vienna). Radiochem. Radioanal. Lett.; 22: No. 3, 195-203(15 Aug 1975).

Sorption of carrier-free radioantimony/^{125}Sb/ from acid aqueous solutions is strongly influenced by the presence of zirconium. For some sorbents (diatomaceous earth, clay minerals, activated charcoal) small amounts of dissolved zirconium salts increase ^{125}Sb sorption strongly. Larger amounts of zirconium reduce sorption again, sometimes below the uptake occurring in the absence of zirconium. With aluminum oxide only a reduction in uptake of ^{125}Sb results from the presence of Zr. These effects can be attributed to the formation of soluble complex species of zirconium with antimony (polynuclear cohydrolysis products) and to their sorption behavior. (auth)

22064 PREPARATION OF CARRIER-FREE RADIOACTIVE ISOTOPES WITH A 14-MeV NEUTRON GENERATOR. III. Preparation of ^{24}Na. Alfassi, Z. B. (Univ. of Negev, Beer Sheva, Israel). Radiochem. Radioanal. Lett.; 22: No. 2, 87-90(16 Jul 1975).

A simple method to produce and separate carrier-free ^{24}Na by irradiation of Al_2O_3 or MgO with 14-MeV neutrons is discussed. ^{24}Na is eluted by neutral, acidic or basic solutions. The use of Al_2O_3 vs. MgO as a target compound is discussed. (auth)

22065 PREPARATIVE THERMO GAS CHROMATOGRAPHIC SEPARATION OF RADIONUCLIDES IN HYDROGEN AND AIR CARRIER GAS STREAM. Eichler, B. (Vereinigtes Institut fuer Kernforschung, Dubna, USSR). Radiochem. Radioanal. Lett.; 22: No. 2, 147-155(16 Jul 1975). (In German).

Different elements can be separated in carrier-free quantities using preparative gas chromatography and temperature programming. By using the hydrogen stream the behavior of At, I, Hg, Po, In, Tl, Cd, Te, Pb and Bi has been investigated, while that of At, Os, Hg, I, Tl, Ru, Tc, Re, Te has been studied in the air stream. The products mentioned were adsorbed on a metallic foil. Thus, samples for high-resolution measurements are prepared simultaneously with the separation of the products. (auth)

22066 USE OF EXTRACTION CHROMATOGRAPHY FOR THE PREPARATION OF RADIOACTIVE ISOTOPES. I. A Generator For ^{113m}In. Alian, A.; Moloukhia, M. K.; Nofal, M. (Atomic Energy Establishment, Cairo). Radiochem. Radioanal. Lett.; 22: No. 2, 81-86(16 Jul 1975).

An extraction chromatographic procedure is described for the periodical preparation of ^{113m}In from its mother ^{113}Sn. This procedure is based on the adsorption of ^{113}Sn on a column of a hydrophobic celite loaded with TDA. Accumulated ^{113m}In can be milked daily by 1.2 M HCl. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 22970, 23923, and 24016.

22067 (BNWL-tr-149) REPROCESSING OF THORIUM-CONTAINING NUCLEAR FUELS. Annual Activity Report, July 1, 1973-June 30, 1974. Laser, D. M. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). 1974. Translated from a German Report. 13p. Dep. NTIS $4.00.

Treatment of radioactive off-gases and highly radioactive wastes by solidification is discussed. Installation of the solidification facility in the chemistry cells was completed, and partial testing and complete cold tests were carried out. (LK)

22068 (CONF-750913-9) REMOVAL OF ACTINIDES FROM HIGH-LEVEL WASTES GENERATED IN THE REPROCESSING OF COMMERCIAL FUELS. Bond, W. D.; Leuze, R. E. (Oak Ridge National Lab., Tenn. (USA)). Sep 1975. 21p. Dep. NTIS $4.25.

From 4th international transplutonium elements symposium; Baden-Baden, F.R. Germany (13 Sep 1975).

Progress is reported on a technical feasibility study of removing the very long-lived actinides (uranium, neptunium, plutonium, americium, and curium) from high-level wastes generated in the commercial reprocessing of spent nuclear fuels. The study was directed primarily at wastes from the reprocessing of light water reactor (LWR) fuels and specifically to developing satisfactory methods for reducing the actinide content of these wastes to values that would make 1000-year-decayed waste comparable in radiological toxicity to natural uranium ore deposits. Although studies are not complete, results thus far indicate the most promising concept for actinide removal includes both improved recovery of actinides in conventional fuel reprocessing and secondary processing of the high-level wastes. Secondary processing will be necessary for the removal of americium and curium and perhaps some residual plutonium. Laboratory-scale studies of separations methods that appear most promising are reported and conceptual flowsheets are discussed. (auth)

22069 (DOCKET 50332-50) BARNWELL NUCLEAR FUEL PLANT. License Application, FSAR, Amendment 11. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). 30 Jun 1975. 169p. Dep. NTIS $11.50.

Amendment No. 11 updates instrumentation information in the Final Safety Analysis Report. (LK)

22070 (DOCKET-701327-5) URANIUM HEXAFLUORIDE FACILITY. License Application, Environmental Report, Revision 4. (Allied-General Nuclear Services, Barnwell, S. C. (USA)). Jun 1975. 18p. Dep. NTIS $4.00.

This revision consists primarily of changes resulting from correcting the uranium isotopic distribution and relocating a UF_6 facility gaseous effluent point. The change in the environmental impact resulting from these changes is insignificant. (LK)

22071 (DOCKET-701729-5) FUEL RECFIVING AND STORAGE STATION. License Application, Amendment 5. (Allied-General Nuclear Services, Barnwell, S. C. (USA)). Jun 1975. 48p. Dep. NTIS $5.50.

The primary purpose of Amendment 5 is to submit supplemental information pertaining to authorizing early operation of the Service Concentrator. (LK)

22072 (DOCKET-701729-6) FUEL RECEIVING AND STORAGE STATION. License Application, Amendment 5, Addendum. (Allied-General Nuclear Services, Barnwell, S. C. (USA)). Jun 1975. 63p. Dep. NTIS $6.25.

This Addendum to AG-L105 addresses the utilization of the Service Concentrator for evaporation of low level wastes generated during fuel receiving and storage operations. The Service Concentrator is described from various viewpoints and necessary relevant data are included for adequate assessment of safety. (LK)

22073 (GA-A-13135) PNEUMATIC CLASSIFICATION OF FORT ST. VRAIN FUEL PARTICLES. deLesdernier, D. (General Atomic Co., San Diego, Calif. (USA)). 30 Jun 1975. Contract AT(04-3)-167. vp. Dep. NTIS $7.60

Closure of the High-Temperature Gas-Cooled Reactor (HTGR) fuel cycle necessarily involves the reprocessing of fuel. During the reprocessing sequence, it is necessary to separate the bred, 100% enriched (U-233) fertile fuel stream from the contaminated (U-235) fissile fuel stream which contains U-238 and the neutron poison U-236. Cross mixing of these fuel streams results in a proportionate cost penalty. For this reason separation of the fuel into its respective components was studied. The various methods of effecting a fertile-fissile fuel particle separation were considered and the method of pneumatic classification was selected for further experimentation. This report discusses a parametric study of pneumatic classification in which a commercial pneumatic classifier and an experimental pneumatic classifier were evaluated to determine the effect of height and feed composition on the efficiency of separation. A model is proposed that can predict crossover of TRISO/TRISO fuel over a wide range of operating conditions once feed composition is known. The model offers potential for further economic evaluation of the fuel cycle. Recommendations are made for prototypical pneumatic classification equipment. (auth)

22074 (GA-A-13255) THORIUM UTILIZATION PROGRAM. Quarterly Progress Report for the Period Ending November 30, 1974. (General Atomic Co., San Diego, Calif. (USA)). 15 Feb 1975. 142p. Dep. NTIS $ 5.45.

This is the second report presenting results of work performed under the National HTGR Fuel Recycle Program. The work reported includes the development of unit processes and equipment for reprocessing of HTGR fuel and the design and development of an integrated line to demonstrate the head end of HTGR reprocessing using unirradiated fuel materials. Work is also described on the evaluation of alternate techniques for fuel reprocessing to surmount possible operating problems with the reference flow sheet and the development of the conceptual design of a target recycle facility to identify the requirements of large-scale recycle of HTGR fuels. (DLC)

22075 (GERHTR-97) REPROCESSING OF THORIUM NUCLEAR FUELS. Annual Activities Report, July 1, 1972-June 30, 1973. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). Aug 1973. Translated from German. 314p. Dep. NTIS $7.60.

Work performed under United States-German High Temperature Reactor Research Exchange Program.

Research in the areas of reprocessing of HTR fuel elements, refabrication of new nuclear fuel particles, and the treatment and storage of radioactive wastes is reported. The planning for the Jupiter pilot plant and testing of equipment for it is outlined. In studies on the purification of combustion waste gases it was pos-

sible to determine the factors governing effective retention and therefore to design the solids filter plant for the Jupiter combustion furnace. The conditions necessary for the continuous dissolution of nuclear fuel particles were determined. The KFA-TBP 23/25 process for the dissolution of sparingly soluble highly sintered oxide heavy particles was completely tested in hot cell trials. The comprehensive work on material balance accountancy was described. Process work on the KFA precipitation process has made it possible to produce UO_2 kernels by this process using $UO_2(NO_3)_2$ casting solutions. Development work has continued on the processing of radioactive wastes. The Kr and T release from the fuel elements under various conditions were determined. Ocean submersion is proposed for the final disposal of ^{85}Kr, whereas T should be concentrated and sealed in suitable storage installations. (JSR)

22076 (GERHTR-136) TREATMENT OF VOLATILE RADIONUCLIDES IN NUCLEAR FUEL REPROCESSING PLANTS. Boehnert, R. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Chemische Technologie). Jul 1974. Translation of JUL-1089-CT. 30p. Dep. NTIS $4.50.

Work performed under United States--German High Temperature Reactor Research Exchange Program.

The volatile radionuclides produced during the utilization of nuclear energy pass into the reprocessing plant with the spent fuel elements. Here the radionuclides are volatilized during fuel element disintegration, during heavy metal dissolution and during the process stage of the solidification of highly radioactive fission product solutions in process-dependent quantities. These quantities exceed, at least locally, the permissible limiting concentrations and may not therefore be released unchecked into the biosphere. The volatile radionuclides occur in the form of aerosols, vapors and gases and undergo specific separation at their site of origin by means of known processes, which are predominantly borrowed from conventional gas purification technology. By enclosure of the separated volatile radionuclides in gas-tight containers, after fixation by adsorption and absorption in solids or liquids, they can in accordance with the present state of the technology be safely sent for ultimate storage. Further studies will have to be made in the future of possible methods for the best form of ultimate storage. (auth)

22077 (JUL-1152) HTR COMBUSTION HEAD-END: COMPARISON OF THE SHAFT-FURNACE AND THE FLUIDIZED-BED PROCESS. Boehnert, R.; Kaiser, G.; Pirk, H.; Tillessen, U. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). Jan 1975. 47p. (In German). INIS.

Two methods of combustion of the graphite of HTR fuel elements are described. Fundamentals of these processes are only given in so far as they are necessary for understanding these techniques. The technological states of these processes are then compared in consideration of the results obtained by Gulf General Atomic. Finally, the possibilities of further development are demonstrated by the example of a pilot plant for a reactor output of 7,000 MWe. (auth)

22078 (REG/G-3.36(8-75)) NONDESTRUCTIVE EXAMINATION OF TUBULAR PRODUCTS FOR USE IN FUEL REPROCESSING PLANTS AND IN PLUTONIUM PROCESSING AND FUEL FABRICATION PLANTS. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Aug 1975. 12p. NRC.

The recommendations of this guide apply to high-integrity tubular products for confinement barriers, for process systems and components, and for radioactive waste handling and storage systems. To adequately control the quality of these tubular products, they should be examined and repaired as follows: (1) All tubular products should be examined for both circumferential and axial defects. (2) Wrought seamless tubular products should be examined and repaired in accordance with NB-2550 of the ASME Code using the acceptance criteria given. When ultrasonic examination is performed, the sound should be transmitted in both directions for each mode of scanning. (3) Examination and repair for welded tubular products (with filler metal added) should be in accordance with NB-2560 of the ASME Code. (LK)

22079 NUCLEAR MATERIALS SAFEGUARDS FOR THE BARNWELL NUCLEAR FUEL PLANT. Molen, G. F. (Allied-General Nuclear Services, Barnwell, SC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the Breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The component facilities and the capacity of the BNFP are described. The material balance determination system and the plant security program are outlined. Security forces are also described briefly. (DLC)

22080 SITUATION ON THE EUROPEAN REPROCESSING MARKET. Voelcker, H. (STEAG AG, Essen). Energ. Nucl. (Milan); 22: No. 6, 327-341(Jun 1975).

From 20th nuclear congress; Rome, Italy (20 Mar 1975).

The European situation in the field of irradiated nuclear fuel reprocessing is reviewed. After, from the comparison of the reprocessing capacities with the needs rising from the present nuclear power programs, the author draws the conclusion that in the 1979-85 period there will be a remarkable shortage of reprocessing capacity: from this the absolute necessity of provisional actions to face that moment, such as the enlargement of the storage facilities at the existing reprocessing plants. After 1985 the situation should improve only on conditions that preparatory work on new reprocessing plants of adequate capacity is started without delay; this requires decisive actions in the frame of strict European collaboration, with governmental support to the private industry. (auth)

22081 CONCEPTUAL DESIGN OF A REPROCESSING PLANT FOR IRRADIATED FAST BREEDER REACTOR FUELS. Boudry, A. (CEA Centre de La Hague, 50 - Cherbourg (France)); Le Bouhellec, J. (CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (France). Dept. de Genie Radioactif); Miquel, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif); Redon, A. (CEA Direction des Productions, 92 - Chatillon (France). Sous-Direction du Plutonium). pp 237-239 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The French program on fast breeder reactors implies setting up an infrastructure for the plutonium fuel cycle, including a reprocessing plant that will be operationnal in 1983 or 1984. It is planned to operate this first plant with the Purex process that was adapted during Rapsodie fuel reprocessing and to also carry on studies of dry processing techniques, whose use should be of interest after 1985. (FR)

22082 OFF-GAS TREATMENT IN SPENT FUEL REPROCESSING PLANTS. Miquel, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif); Lebouhellec, J. (CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (France). Dept. de Genie Radioactif); Cantel, J. (CEA Direction des Productions, 92 - Chatillon (France)). pp 239-241 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The CEA has developed a research program on the retention and and conditioning of iodine (^{131}I and ^{129}I) and the removal of tritium and noble gases. (FR)

CONTROLLED THERMONUCLEAR RESEARCH

Plasma Confinement and Heating

22083 (AED-CONF-75-043-007) ELECTRON HEATING BY BEAM-PLASMA INTERACTION IN A MAGNETIC MIRROR FIELD. Fuchs, G. (Marburg Univ. (F. R. Germany). Fachbereich Physik). 1975. 7p. (In German). INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

7 figs.

Experiments have shown that plasma oscillations are accompanied by fast X-ray quanta whose energy is considerably higher than that of the primary beam electrons. Measurement of the degree of polarization of the X-rays showed that the energy of these fast electrons flows perpendicularly to the magnetic field. This fact proves that the electron heating mechanism is indeed electron-cyclotron resonance. (GE)

22084 (BNL-20297) HEAVY ION SPACE CHARGE LIMITS. Maschke, A. W. (Brookhaven National Lab., Upton, N. Y. (USA)). 21 Jul 1975. 4p. Dep. NTIS $4.00.

Modern ultra-high vacuum technology makes it possible to accelerate and store heavy ions in low charge states. Such quasi-neutralized beams give rise to very high space charge limits in conventional charged particle storage rings and transport systems. In addition, the z^2 dependence of dE/dx gives rise to very short ranges for very high energies. Space charge limits are evaluated for a linear transport system, and it is shown that realistically achievable powers and energies are of interest for the ignition of thermonuclear pellets. (auth)

22085 (IFA-FR-136-1975) COMPUTATION PROGRAM FOR DETERMINING THE SPACE TEMPERATURE AND DENSITY OF THE ION DENSITY WITHIN A THERMONUCLEAR REACTOR, THE THERMONUCLEAR PLASMA OF WHICH IS CONTROLLED BY FISSION REACTIONS DSTD CODE. Cristea, G. (Comitetul de Stat pentru Energia Nucleara, Bucharest (Romania)). May 1975. 14p. Dep. NTIS (US Sales Only) $4.00.

A computation program is described that endeavors to give the space distribution of the temperature and of the ion density within the stationary thermonuclear plasma of such a type of thermonuclear reactor. None of these distributions is examined for each ion population. For the population of the thermonuclear ions a model of a perfect gas is assumed for which the macroscopic parameters are computed on the basis of the microscopic parameters of the thermonuclear plasma. The following topics are described here; the discreting manner of the heat equation, the limit conditions, the temperature determination by a recurrence relation, and the iteration cycle used for determining the temperature at every step. (auth)

22086 (LA-UR-75-905) STAGED THETA PINCH EXPERIMENTS. Linford, R. K.; Downing, J. N.; Gribble, R. F.; Jacobson, A. R.; Platts, D. A.; Thomas, K. S. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. 5p. (CONF-750905-18). Dep. NTIS $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Two concepts are presented for producing theta pinch plasmas with larger ratios of plasma radius to discharge tube radius than are produced in standard theta pinches. The experiments for testing these concepts and preliminary results are described. (auth)

22087 (ORNL-tr-4000) SYNCHROTRON STUDY OF ESCAPING ELECTRONS IN TOKAMAK TM-3. Vlasenkov, V. S.; Larionov, M. M.; Roshdestvenskii, V. V. 1974. Translation by Martha Gerrard of NP-20330. 7p. Dep. NTIS $4.00.

Measurements of the radiation plasma temperature in 4 and 8-mm wavelength bands on tokamak TM-3 are described. Nonthermal radiation with temperatures approximately equal 10 keV was registered. Nonthermal radiation is supposed to be synchrotron radiation of "run away" electrons. Their properties were also considered. On the base of data obtained parameters of the "run away" electron flux were estimated. (auth)

22088 (ORO-4211-18) PLASMA HEATING AND CONFINEMENT. Progress Report Through June 1975. (Tennessee Univ., Knoxville (USA)). 1975. 6p. Dep. NTIS $4.00.

The heating process in the hot-electron machine is discussed. The heating does not appear to be electron cyclotron resonance, but has many of the characteristics of parametric heating. A second set of observations concerns the operation of the plasma at much lower pressure in a simple mirror than is commonly considered possible (on the order of 10^{-6} torr). The expected flute instability apparently occurs late in the decay, about 50 msec after power turn-off. This is described in some detail. (MOW)

22089 (UCRL-76491) THEORETICAL X-RAY CONVERSION EFFICIENCIES AND SPECTRA OF SINGLE ELEMENT PLANE TARGETS HEATED BY HUNDRED PICOSECOND LIGHT PULSES FROM NEODYMIUM GLASS LASERS. Grasberger, W. H.; Violet, C. E.; Richards, L. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1975. 24p. (CONF-750427-5). Dep. NTIS $4.25.

From meeting of the American Physical Society; Washington, District of Columbia, USA (28 Apr 1974).

A non-LTE rate equation computer program was combined with a program which simulates the heating of laser-heated targets in plane geometry. The hydrodynamic program calculates the absorption of laser light, the electron and ion temperatures—allowing for electron heat conduction—and the densities each time-step and feeds these values to the rate equation program. The rate equation program gives to the hydrodynamic program for each time-step a source-sink term for each hot zone above 20 eV, representing the net emission and adsorption of x rays. The calculations presented involve approximately ten hot and ten cool zones. (MOW)

22090 (UCRL-77221) RECENT MIRROR MACHINE RESULTS AND THEIR IMPLICATIONS FOR MIRROR SYSTEMS. Post, R. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Aug 1975. 11p. (CONF-750905-16). Dep. NTIS $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Improved confinement recently achieved in the Livermore 2XIIB experiment is interpreted in terms of warm plasma stabilization of the drift-cone mode. The same theoretical model explains present and earlier mirror observations and also predicts improved prospects for achieving classical plasma loss rates in mirror fusion reactors. (auth)

22091 (UCRL-77255) RECENT EXPERIMENTS ON THE 2XIIB MIRROR MACHINE. Coensgen, F. H.; Cummins, W. F.; Logan, B. G.; Molvik, A. W.; Nexsen, W. E.; Simonen, T. C.; Stallard, B. W.; Turner, W. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Aug 1975. 9p. Dep. NTIS $4.00.

Plasma confinement experiments with neutral beam injection in the 2XIIB Magnetic mirror facility are described. Ion heating to 13 keV and build-up of hot ion densities to 4×10^{13} cm^{-3} are measured when streaming plasma is introduced to suppress microinstabilities. Increasing ion energy is found to increase n tau. (auth)

22092 SYMPOSIUM ON PLASMA HEATING IN TOROIDAL DEVICES, VARENNA, ITALY, SEPTEMBER 4–17, 1974. Bologna; Editrice Compositori (1974). 267p. (CONF-740969-).

Separate abstracts were written for 44 of the included papers. The remaining four papers appeared previously in NSA. (MOW)

For abstracts of individual papers see: 22093–22126, 22130, 22136–22138, and 22145–22150.

22093 PLASMA HEATING BY NEUTRAL-INJECTION AND RADIOFREQUENCY METHODS. Stix, T. H. (Princeton Univ., NJ). pp 2-5 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

A brief comparison is made of neutral injection and radio-frequency heating of tokamak plasmas. The successes and pitfalls of each method are discussed. (MOW)

22094 RF-HEATING APPROACH TO IGNITION IN LOW-β-TORI. Canobbio, E. (Association EURATOM–CEA, Grenoble, France). pp 6-9 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The main aspects of the rf heating approach to the ignition problem in low-beta toroidal devices are discussed. The processes analysed in some detail are : ion and electron TTMP, ICRH including heating at multiples of the ion gyrofrequency, and heating at the lower hybrid resonance. Emphasis is put on the basic physical scaling laws relevant to ignition, on the essential questions which remain to be settled, and on the main technical

constraints upon the application of the various rf schemes in reactor oriented devices. (auth)

22095 SURVEY ON THE RF HEATING RESEARCH ON TOROIDAL DEVICES IN USSR. Consoli, T. (Association EURATOM-CEA, Grenoble, France). pp 10-19 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The survey covers research at the Effremov, Ioffe, and Kurchatov institutes. The rf heating processes discussed are divided into three classes: (1) the low frequency processes at TTMP, acoustic and magnetoacoustic, icr at fundamental and its harmonics, (2) the hf processes, as lower hybrid mode and ion parametric mode, and (3) the very hf processes as ecr the upper hybrid mode, and electron parametric mode. (MOW)

22096 TTMP EXPERIMENT ON PETULA. Parlange, F. (Association EURATOM-CEA, Grenoble, France). pp 20-23 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Some expected results from TTMP on Petula are described. Equilibrium temperatures are described when ignition cannot be reached because of increased energy losses. Within the same time, temperature above 10 keV can be reached with about 3×10^{-3} cy/sec. modulation. (MOW)

22097 WEGA ASTELLARATOR FOR RF HEATING STUDIES. Ichtchenko, G. (Association EURATOM-CEA, Grenoble, France). pp 24-27 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

WEGA a joint experiment of IPP Garching, CEA Grenoble, and ERM Bruxelles, is now under construction in Grenoble. It is designed as an ohmically heated stellarator whose parameters and performances should be intermediate between WENDELSTEIN II and WENDELSTEIN VII, and comparable with CLEO or with a tokomak like PETULA. The lower hybrid resonance heating will be investigated during the first experimental phase in view of the application to the next generation experiments (w VII or JET). The present paper intends to summarize the principle, parameters, and experimental program of WEGA. (auth)

22098 SURVEY OF EXPERIMENTS AND THEORY OF PARAMETRIC INSTABILITIES AND PLASMA HEATING. Porkolab, M. (Princeton Univ., NJ). pp 28-40 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The results are summarized for a number of recent experiments on parametric instabilities and related plasma heating. Particular attention is given to the regime of Trivelpiece-Gould modes, lower-hybrid frequency, ion-cyclotron frequency (fast magnetosonic wave), and upper-hybrid frequency. An elementary treatment of the theoretical concepts is also presented. (auth)

22099 FAST COMPRESSION WAVES IN THE ION CYCLOTRON RANGE. Samain, A. (Association EURATOM-CEA, Fontenay-aux-Roses, France). pp 50-54 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The structure of fast compression waves is considered in the ion cyclotron range which may exist in a Tokamak plasma. The regimes considered are those induced by a coil system when a single eigenmode or a continuum-like family of modes are excited. The electromagnetic fluctuations associated with thermal excitation of the waves are examined. The main nonlinear damping mechanisms of the waves are reviewed. (auth)

22100 BOUNDED PLASMA ASPECTS OF THE RF HEATING OF TOROIDAL MACHINES. Messiaen, A. (Ecole Royale Militaire, Brussels). pp 55-60 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The main features of the basic theoretical model are outlined. Topics considered are the following: (1) plasma description, (2) plasma-vacuum boundary conditions, (3) coil loading, (4) ion TTMP domain ($\omega \sim |k_{\parallel} v_i|$), (5) Alfven wave resonance domain, (6) influence of the inhomogeneity of the steady magnetic field on the Alfven wave resonances, and (7) the frequency domain above ω_{ci}. (MOW)

22101 ION CYCLOTRON HEATING RESULTS ON THE ST TOKAMAK. Hooke, W. M. (Princeton Univ., NJ). pp 71-73 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

In the previous paper Hosea has given a description of the wave coupling and modes in the ST Tokamak. This paper is related to his by describing which of these modes were used and which could not be used in the heating of the ST device. The coupling system used in the heating experiments was the same used in the experiments described by Hosea. (auth)

22102 LINEAR WAVE CONVERSION AT THE LOWER HYBRID RESONANCE. Fidone, I. (Association EURATOM-CEA, Fontenay-aux-Roses, France). pp 74-75 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Linear wave conversion at the lower hybrid layer for a parabolic density profile is investigated. The saturation of the variable index as a result of the Miller force is also discussed. (auth)

22103 PARAMETRIC INSTABILITIES AND PLASMA HEATING NEAR THE LOWER HYBRID FREQUENCY. Fidone, I. (Association EURATOM-CEA, Fontenay-aux-Roses, France). pp 76-77 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Quasi-linear theory of parametric turbulence in a magnetized plasma is considered. For a frequency ω_0 of the pump field above the lower hybrid resonance the ratio of the heating rates of electrons and ions is estimated. (auth)

22104 ABSORPTION OF THE LOWER-HYBRID WAVE IN A THERMONUCLEAR PLASMA. Puri, S. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). pp 83-90 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Computations using the full hot-plasma dielectric tensor show that the lower-hybrid characteristics depart significantly from the analytic results of Stix and Glagolev. The discrepancy is traced to the neglect of the terms involving higher-order Bessel functions while performing the summations for obtaining the components of the dielectric tensor, leading to the breakdown of the analytical approaches in the neighbourhood of the resonance. For typical thermonuclear parameters the damping term due to electron resistivity dwarfs the contribution due to Landau damping. Conversion of the lower-hybrid wave to either the acoustic or the cyclotron-harmonic modes seems neither plausible nor necessary for the purpose of energy absorption. Boundary value solutions using stepped slab model show that the penetration problem of the electromagnetic wave into the plasma is not materially affected by the inclusion of finite temperature effects. As the wave approaches the hybrid layer, the Poynting vector decreases with a corresponding increase in the energy transport due to the particle motion. This energy is, in turn, deposited into the plasma electrons through resistive absorption near the resonant layer where the group velocity becomes considerably less than the ion-thermal speed. The wave is efficiently absorbed even at the plasma temperature of 10^6 °K when the ratio of collision frequency to wave frequency is $\nu/\omega \sim 10^{-7}$. (auth)

22105 ION-SOUND AND ION-CYCLOTRON WAVES PARAMETRICALLY DRIVEN BY A PUMP FIELD ABOVE THE LOWER-HYBRID RESONANCE. Chu, T. K.; Lee, Y. C.; Porkolab, M. (Princeton Univ., NJ). pp 102-104 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Both ion-sound and ion-cyclotron waves can be driven parametrically unstable by a high-frequency field near but above the lower-hybrid resonance. The mode structure of the pump wave plays an important role in the coupling mechanism to the various branches of parametric-ion waves, including the multi-ion species Buchsbaum-hybrid resonance. Numerical results of the linear dispersion relations of the parametrically-driven ion-cyclotron waves including ion-cyclotron damping, and ion-quasi modes are obtained in the regime $T_e \leq T_i$, and are compared with recent heating experiments in alkali-metal plasmas. (auth)

22106 FAST-WAVE HEATING OF A TWO-COMPONENT PLASMA. Stix, T. H. (Princeton Univ., NJ). pp 105-109 of

Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

The use of the compressional hydromagnetic mode (also called the magnetosonic or, simply, the fast wave) is examined in some detail with respect to the heating of a tritium plasma containing a few percent deuterium. Efficient absorption of wave energy by the deuteron component is found when $\omega = \omega_c$ (deuterons), with $Q_{wave} \gtrsim 100$. Coherence effects between transit-time and Landau damping for electrons reduce the total absorption for both processes to one-half of the transit-time power, calculated separately. Q_{wave} based on electron damping alone is $\gtrsim 5/\beta$. The wavelengths under these conditions are favorable for efficient coupling to intermediate-size tokamaks such as PLT and PDX, but the high density of modes in larger devices (TCT, reactors) will tend to frustrate attempts to excite optimum single modes, and careful attention will have to be paid to narrow-band antenna structures and variable-frequency mode-tracking. The fusion output of a two-component neutral-injected plasma can be enhanced by selective heating of the injected deuterons. Also, selective deuteron absorption may be used for ion tail creation by radiofrequency excitation alone, as an alternative to neutral injection. The dominant behaviour of the high-energy deuteron distribution function is estimated as $f(v) \sim \exp[\alpha \int^v dv \langle \Delta v \rangle / \langle (\Delta v_\perp)^2 \rangle]$, where $3/2 > \alpha > 1$, $\langle \Delta v \rangle$ is the Chandrasekhar-Spitzer drag coefficient, and $\langle (\Delta v_\perp)^2 \rangle$ is the Kennel-Engelmann quasilinear diffusion coefficient for wave-particle interaction at the deuteron cyclotron frequency. (auth)

22107 ELECTRO-MAGNETIC EIGENMODES OF THE TOROIDAL CAVITY. Brambilla, M.; Finzi, U. (Association EURATOM–CEA, Grenoble, France). pp 110-112 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

The eigenmodes of the empty toroidal cavity, relevant for high frequency heating of toroidal plasmas, are calculated using a development in the inverse aspect ratio. The eigensolutions are classified as quasi-TE and quasi-TH modes according to their cylindrical limit. Two exceptional modes are found for which both the electric and the magnetic field in the axial direction are nonzero already to the lowest order. The existence of these modes is connected with the accidental degeneracy of the cylindrical TH_1 and TE_0 modes. (auth)

22108 THEORY OF SLOW WAVE COUPLING TO THE LOWER HYBRID RESONANCE IN THERMONUCLEAR DEVICES. Brambilla, M. (Association EURATOM–CEA, Grenoble, France). pp 113-119 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

As is well known, the lower hybrid resonance (LHR) is accessible from outside a plasma only if the wave is slowed down along the static magnetic field so as to satisfy the accessibility condition $n_\parallel^2 > 1 + \omega_{pe}^2/\Omega_{pe}^2$. There are still claims, however, that this condition can be violated in practice, while still efficiently coupling energy to the plasma. These claims are discussed and it is shown that the condition should indeed be satisfied in large and dense devices. A multi-waveguide launching structure was designed to satisfy the condition while minimizing (within the uncomfortable limits imposed to any h.f. heating method by the presence of large electric fields near the plasma) the compatibility problems with the environment of large fusion-oriented devices. The exact solution for the electromagnetic fields of the Grill both without and with the plasma as a load is presented. (MOW)

22109 LHR HEATING SLOW WAVE LAUNCHING STRUCTURE SUITED FOR LARGE TOROIDAL EXPERIMENTS. Lallia, P. (Association EURATOM–CEA, Grenoble, France). pp 120-121 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

In reactor oriented devices, like Tokamaks or Stellarators ($n_e > 5 \times 10^{13} cm^{-3}$, $B \simeq 30$ to 40KG on the axis), the Low Hybrid Resonance frequency is $\simeq 800$ MHz. However, the "accessibility" condition requires slowing down the wave parallel to $\vec{B}$, which is usually produced by some mechanical structure located between the plasma and the vacuum wall. A new structure is described that consists of a compact set of properly phased waveguides, called "Grill", which is able to launch effectively a slow wave to the plasma without reducing the useful cross section of the liner. (auth)

22110 COMMENT ON THE PAPER "THEORY OF SLOW-WAVE COUPLING TO LHR IN THERMONUCLEAR DEVICES". Brambilla, M.; Lallia, P. (Association EURATOM–CEA, Grenoble, France). pp 122 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

The theory of the multi waveguide launching system predicts a prohibitive amount of power reflected back into the phased array of oscillators to which the individual waveguides are connected. An argument is given that shows that these reflections are inherent to slow wave coupling schemes. (MOW)

22111 LOWER HYBRID RESONANCE AND PARAMETRIC DECAY INSTABILITY EXCITED BY A SLOW WAVE DEVICE. Brusati, M.; Cima, G.; Fontanesi, M.; Sindoni, E. (Association CNR–EURATOM, Milan). pp 123-124 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Some experimental results are presented concerning parametric instabilities excited by a pump field above the lower hybrid frequency. The experiment was performed in a linear device in the electron density range 5×10^{10} to 5×10^{11} cm^{-3}, with a static magnetic field $B \lesssim 2$ KGauss in hydrogen plasma and with a background pressure of the order of 10^{-5} torr. In these conditions the lower hybrid frequency range on the axis of the plasma is 10 to 40 MHz. (MOW)

22112 HIGH-TEMPERATURE, HIGH-DENSITY REDUCTION OF HARMONIC ION-CYCLOTRON HEATING EFFICIENCY. Weynants, R. R. (Ecole Royale Militaire, Brussels). pp 130-133 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

A rather restrictive high-temperature, high-density limitation $k_z \geq \omega_{pi} 2\nu_i \omega_{ci}^{-1} c^{-2}$ is shown to profoundly affect the efficiency of first-harmonic ion-cyclotron heating. (auth)

22113 NEUTRAL INJECTION HEATING: AN INTRODUCTION. Sweetman, D. R. (Culham Lab., Abingdon, Eng.). pp 134-136 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

The advantages and problem areas of neutral injection heating in tokamak plasmas are summarized. Some of the topics considered are the effects of hot ion pressure, charge exchange losses, plasma rotation, distortion of the ion energy distributions, microinstabilities, and two-component fusion systems. (MOW)

22114 NEUTRAL INJECTION AS THE PRIMARY HEATING SOURCE IN TOROIDAL SYSTEMS. Sweetman, D. R. (Culham Lab., Abingdon, Eng.). pp 137-140 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Some advantages of neutral beam injection into stellarators or multipoles are discussed. Plasma build-up conditions are given. Energy balance conditions are also discussed. (MOW)

22115 NEUTRAL-BEAM HEATING IN THE ADIABATIC TOROIDAL COMPRESSOR. Eubank, H. P. (Princeton Univ., NJ). pp 141-146 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Energy transfer calculations for neutral beam injection heating are discussed. Ion temperature measurements are plotted. (MOW)

22116 NEUTRAL INJECTION EXPERIMENTS ON ORMAK. Berry, L. A. (Oak Ridge National Lab., TN). pp 147-150 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

The isolation of the beam induced component of the ion heating is discussed. This was done by measuring the variation in ion temperature as a function of electron density for discharges both with and without neutral injection. One finds that almost all of the additional heating is due directly to the beam injection and not to the associated increase in plasma density. (MOW)

22117 THEORY OF NEUTRAL BEAM INJECTION. Berry, L. A. (Oak Ridge National Lab., TN). pp 151-154 of Symposium

on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The initial trapping process is discussed. The beam slowing down process is discussed in order to delineate the division of power between ions and electrons. An estimate is given of the expected plasma heating. (auth)

22118 APPLICATION OF RF PUMPING TO PLASMA PURIFICATION. Samain, A. (Association EURATOM-CEA, Fontenay-aux-Roses, France). pp 166-173 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Methods of preventing contamination of a tokamak plasma without using a divertor are considered. A strong thermal gradient (eventually obtained by external heating of ions at the center of the plasma) should prevent collisional inward diffusion of impurities in the realistic case where impurities are in the Pfirsch Schluter regime and hydrogen ions are in the banana or plateau regime. Another possibility consists of giving to circulating hydrogen ions an ordered velocity along the flux lines of the order of the diamagnetic velocity. Such a motion could be obtained by a magnetic pumping of small amplitude. The use of a rf field oscillating at the cyclotron frequency of impurity ions, so that these ions become trapped in ripples of the toroidal field in a region of space where they drift outwards, is discussed. (auth)

22119 DIFFUSION PRODUCED BY TRANSIT TIME MAGNETIC PUMPING. Stringer, T. E. (Culham Lab., Abingdon, Eng.). pp 178-181 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The response of the plasma to transit time magnetic pumping is analysed using the kinetic equation, and the resulting diffusion evaluated. The approach is similar to the neoclassical theory of toroidal diffusion, but the electric field induced in the plasma by the time-varying magnetic field introduces important new effects. The effect of the helical magnetic field of a stellarator on TTMP is considered. This causes the diffusion in a stellarator to be appreciably greater than in a comparable axisymmetric system. The rapid pump-out observed when TTMP was applied to the Proto-Cleo Stellarator is consistent in many respects with this analysis. (auth)

22120 ADIABATIC COMPRESSION OF TOROIDAL DISCHARGES. Ellis, R. A. Jr. (Princeton Univ., NJ). pp 199-217 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The relation of adiabatic compression to the problem of supplemental heating of tokamaks is discussed and a simple theory of adiabatic compression is presented. Included in the simple theory are MHD scaling laws and criteria for equilibrium and stability. The following three modes of compression are discussed: (1) constant major by increase of toroidal field, (2) compression with decrease of major radius in constant toroidal field; and (3) compression with decrease of major radius and increase of toroidal field. The possible application of compression heating in a reactor is reviewed as well as the role of compression in so called "two component systems." The ATC device at Princeton is described in detail as an application of compression heating in tokamaks. The ATC device seems to show compressional heating in accord with the predictions of simple MHD theory. Experimental results which were obtained from the ATC device are presented as an example of compressional heating. (auth)

22121 TURBULENT HEATING AND ANOMALOUS CONDUCTIVITY. Hamberger, S. M. (Culham Lab., Abingdon, Eng.). pp 218-220 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

Brief discussions are given for the following topics: (1) scaling laws for anomalous conductivity, (2) requirements for successful application of turbulent heating, (3) main conclusions from the fast toroidal turbulent heating experiment, and (4) some problems associated with finite current penetration in large devices. (MOW)

22122 CURRENT BUILD-UP IN A PLASMA DISCHARGE WITH A MOVING LIMITER. Bardotti, G.; Enriques, L.; Santini, F. (Laboratori Gas Ionizzati, Frascati, Italy). pp 221-224 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

A simple model is considered for the plasma discharge. Thermal conductivity is considered in the model. Analytical solutions are given which makes possible a general investigation of the influence of the plasma parameters as well as of the relations between the limiter motion and the current rise in time. (MOW)

22123 SPLITTING OF THE ELECTRON POPULATION BY THE ELECTRIC FIELD IN A TOROIDAL PLASMA. Pozzoli, R. (Massachusetts Inst. of Tech., Cambridge). pp 225-228 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

In a high temperature toroidal plasma, in conditions where magnetic trapping occurs for a relevant fraction of the electron population (banana regime), the electron distribution function can be strongly distorted by the toroidal electric field produced by the transformer. This distortion can lead to a double peaked distribution in a time smaller than the inverse effective collision frequency for trapped electrons. (auth)

22124 HEATING AND INJECTION STUDIES WITHIN THE EUROPEAN COMMUNITY. Watson, C. J. H. (Culham Lab., Abingdon, Eng.). pp 229-235 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The analysis is based on a report recently published by the Euratom Heating and Injection Advisory Group. The methods considered are: anomalous Ohmic heating, turbulent heating, adiabatic compression, shock heating, neutral atom injection, cluster injection, relativistic electron beam heating, gun plasma injection, ion TTMP, electron TTMP, RF heating at the ion cyclotron frequency and its harmonics and the lower hybrid frequency, and laser heating. The heating and injection experiments which are currently under construction or in operation within Euratom-associated laboratories are described. (auth)

22125 ALPHA-PARTICLE HEATING OF TOKAMAK PLASMAS. Jassby, D. L. (Princeton Univ., NJ). pp 259-262 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The partial pressure of fusion-generated alpha particles in an ignited D-T reactor is similar to that of a suprathermal deuteron population injected to heat the plasma to ignition. The role of fusion alphas during beam heating to ignition may be enhanced if optimally reacting D beams (150 to 300 keV) are used, if energy clamping is utilized, and in particular if most of the plasma is heated by a propagating thermonuclear burn. These techniques minimize the required beam-injector capacity, and allow substantial fusion energy multiplication even in a pulsed ignition device. (auth)

22126 HEATING OF TOROIDAL DEVICES BY MEANS OF CLUSTER INJECTION. Bottiglioni, F.; Coutant, J.; Fois, M. (Association EURATOM-CEA, Fontenay-aux-Roses, France). pp 263-265 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

A cluster is defined as a microcrystal of solid hydrogen where the molecules are held together by Van der Waals forces which are 0.02 eV per molecule. Cluster production and main features of the cluster are discussed. Ionization and acceleration of the cluster are described along with cluster injection for plasma heating. (MOW)

22127 COMPARATIVE STUDY OF LYMAN CONTINUUM, SOFT X-RAY OR HARD X-RAY HEATING OF AN OPTICALLY THIN GAS. Bergeron, J. (Cornell Univ., Ithaca, N. Y. (USA). Center for Radiophysics and Space Research); Collin-Souffrin, S. (Observatoire de Paris, Section de Meudon, 92 (France). Dept. d'Astrophysique Fondamentale). Astron. Astrophys.; 36: No. 1, 27-40(Nov 1974).

15 figs.; 2 tabs.; 33 refs.

The results of a systematic study of the steady-state equilibrium of a gas heated predominantly by Lyman continuum, soft X-ray or hard X-ray photons are presented. Special emphasis is given to the spectral dependence (i.e., power law, exponential and black-body spectra) and to the effects of low energy cut-offs in the optical to keV energy range. The influence of secondary

electrons and Auger transitions for the heavy elements has been taken into account. The present study applies to cold gases ($30 \lesssim T \lesssim 1.5 \times 10^4$ K). It is found that some observable gas parameters (i.e., temperature, degree of ionization of hydrogen and heavy elements) could yield significant knowledge of the radiation field, as well as of other gas characteristics. (auth)

Plasma Diagnostics

Refer also to abstracts 23032 and 23033.

22128 (COO-2444-2) DEVELOPMENT OF A BEAM PROBE DIAGNOSTIC SYSTEM FOR THE UNITED AIRCRAFT "LITE" PROGRAM. Final Progress Report, 1 April 1974–31 March 1975. Stufflebeam, J. H.; Jennings, W. C.; Connor, K. A.; Hickok, R. L. Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). Jul 1975. Contract AT(11-1)-2444. 62p. Dep. NTIS $6.25.

A heavy ion beam probe diagnostic system for the LITE plasma device was designed, fabricated, tested and installed. The beam was aligned and slaved to the LITE magnetic field and the predicted defocusing of the beam was confirmed. A sophisticated Beam Trajectory Programmer to control the operation of the beam probe system was developed and placed into operation. The electrostatic energy analyzer detector system was installed and preliminary noise measurements were made. The system is now ready for final testing under full plasma operating conditions. (auth)

22129 (NP-20444, pp 103-104) DETERMINATION OF ELECTRON DENSITY AND ELECTRON COLLISION FREQUENCY IN A NON-MAXWELLIAN PLASMA BY AN RF COIL PROBE. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

22130 INTERACTION OF CO_2 LASER RADIATION WITH WEAKLY UNDERDENSE PLASMAS IN A STRONG MAGNETIC FIELD. Chu, T. K.; Johnson, L. C. (Princeton Univ., NJ). pp 238-243 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Space- and time-resolved interferometric measurements of electron density in CO_2-laser produced plasmas in helium or hydrogen are made near the laser focal spot. Immediately after breakdown, density increases in time at the focal point, with lower density away from the focal point. After a few tens of nanoseconds, shock waves are formed, propagating both transverse and parallel to the incident laser beam direction. Behind the transverse propagating shock is an on-axis density minimum, which results in laser beam self-focusing. The shock wave propagating toward the focusing lense effectively shields the interior plasma from the incident beam, because the lower plasma temperature and higher plasma density in the shock allows strong absorption of the incident beam energy. By arranging the laser radiation-plasma interaction to begin at a plasma-vacuum interface at the exit of a free-expansion jet, this backward propagating shock wave is eliminated, thus permitting efficient energy deposition in the plasma interior. A strong magnetic field is observed to inhibit the lateral expansion of the plasma. (auth)

Plasma Kinetics (General)

22131 (BNL-tr-609) EXPERIMENTAL FACILITY FOR DETERMINING PLASMA CHARACTERISTICS IN ION SOURCES. Abroyan, M. A.; Kagan, Yu. M.; Kolokolov, N. B.; Lavrov, B. P. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1974. Translation by S. J. Amoretty of NIIEFA-D-0220. 29p. Dep. NTIS $4.50.

A facility for optical and electrical measurements of the plasma parameters in the arc plasma ion sources is described. The potentialities of the system are demonstrated on the basis of the electron concentration, the electron energy distribution function, and the radial population distribution of the excited states of hydrogen atoms in the arc plasma of the duoplasmatron. (auth)

22132 LABORATORY OBSERVATIONS OF ELECTRON TEMPERATURE IN THE WAKE OF A SPHERE IN A STREAMING PLASMA. Oran, W. A. (George C. Marshall Space Flight Center, Huntsville, AL); Stone, N. H.; Samir, U.; Fontheim, E. G. Planet. Space Sci.; 23: No. 7, 1081-1083(Jul 1975).

A parametric study was performed of electron temperature variation in the wake of a conducting sphere in a streaming plasma. The flow conditions were varied as follows: the ambient electron temperatures in the range 850 to 2450 K; the ambient electron densities in the range 5×10^4 to 7×10^5/cm^3; and body potentials relative to plasma potential in the range of +1.7 to –2.8 V for an ion beam energy of ~4 eV. Electron temperature enhancements were observed which ranged up to 200% above ambient in the nearest proximity of the body surface. The magnitude of the enhancement depends upon the ambient density, temperature and body potential. (auth)

22133 DETERMINATION OF THE PLASMA CLUSTER MASS IN THE RAIL ACCELERATOR. Maftul, J.; Maloch, J. (Czech Technical Univ., Prague). Czech. J. Phys.; 25: No. 6, 677-685 (1975).

Calculations of the plasma cluster mass when changing discharge voltage and capacity of the capacitor battery were performed. The plasma cluster mass is calculated on the basis of experimentally determined dependence of the plasma cluster path on time. Due to these results it is possible to justify the application of the "snow-plough" model to this type of the plasma accelerator. (auth)

Plasma Kinetics (Theoretical)

22134 (LRP-91/75) SCREW PINCH SIMULATED BY AN ELASTIC CORD IN MOTION. Keller, R.; Bachmann, W.; Pochelon, A. (Ecole Polytechnique Federale, Lausanne (Switzerland)). May 1975. 12p. (In French). Dep. NTIS (US Sales Only) $4.00.

The m equals 1 mode of a plasma column is represented by means of a mechanical setup which shows the helical shape displayed by a linear screw pinch with fixed axial boundaries. (auth)

22135 (NP-20444, pp 101-103) NEW APPROACH TO STUDY THE HYDRODYNAMICS OF A PLASMA. Majumdar, S. K. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

22136 INDUCED VORTICITY IN HIGH DENSITY PLASMA. Lisitano, G. (Association EURATOM–Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). pp 78-82 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Plasma vortex tubes surrounding the core of a high density plasma are induced by means of a new model of rotating plasma beams. Hydromagnetic interpretation of the induced plasma vorticity is derived from the measured plasma streamlines. (auth)

22137 ANOMALOUS TRANSPORT PROCESSES IN HIGH TEMPERATURE TOROIDAL PLASMAS. Coppi, B.; Pozzoli, R.; Rewoldt, G.; Schep, T. (Massachusetts Inst. of Tech., Cambridge). pp 155-158 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Significant transport processes resulting from the excitation of relatively small levels of fluctuations in confined plasmas are investigated in regimes where a fraction of the electron and/or ion population is trapped. If a second maximum in the electron distribution is formed by the circulating electrons under the influence of an electric field, while trapped electrons remain locked in with the magnetic field, current driven modes travelling as well as standing along the magnetic field can be excited. Standing modes are shown to "resonate" with different portions of the electron distribution at the same time, and provide a momentum exchange between circulating and trapped electrons that can prevent a runaway process as well as produce an effective electrical resistivity. A depletion of impurity ions from the center of a plasma column is shown to be produced by impurity driven modes when a significant temperature gradiant of the main ion population is present. This favorable effect is accompanied by ion thermal conductivity, across the magnetic field, enhanced over its collisional value. Particle and electron energy transport are produced by a new, "ubiquitous," mode that does not require a fraction of the ion population to be trapped, exists with or without a significant electron collision rate, and is driven by the electron temperature gradient or by the unfavorable magnetic curvature drift of the ions and trapped electrons, for proper values of the transverse wavelength. Finally, a spatially inhomogeneous hot ion population, resulting from the injection of a beam of fast neutrals for the purposes of ion heating or tritium burning, is shown to induce collective modes which may enhance the rate of energy loss to the main ion population and induce particle transport across the magnetic field of the base plasma. (auth)

22138 NUMERICAL FOKKER–PLANCK STUDIES OF TWO COMPONENT TORI. Gardner, J. H.; Winsor, N. K.; Wagner, C. E.; Boris, J. P. (Naval Research Lab., Washington, DC). pp 244-258 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Several model Two-Component Tori including: time dependent, adjustable, beam and plasma parameters; nuclear reactions; impurities; radiation losses and recycling; are used to assess the feasability of scientific breakeven. The computer models are described in detail, the results of approximately 600 model experiments are summarized and optimum parameters for clamped and unclamped systems are extracted. Breakeven is shown to be a reasonable extrapolation from present-day machines. (auth)

22139 CORRELATION FUNCTIONS OF CURRENTS AND NONLINEAR SUSCEPTIBILITIES IN NONEQUILIBRIUM ISOTROPIC PLASMA. Kocherga, O. D. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 1, 148-153 (Jan 1975). (In Russian).

The connection between the spectral representation of current density fluctuations and the imaginary parts of the nonlinear electric susceptibilities is considered in nonequilibrium isotropic plasma. The relations are obtained which generalize the fluctuation–dissipation theorem for the case of nonequilibrium isotropic media where the nonlinear effects are of essential importance. (auth)

Plasma Production

22140 (UCRL-75979) ACCELERATION OF POLYETHELENE FOILS BY LASER DRIVEN ABLATION. Ahlstrom, H. G.; Burginyon, G. A.; Haas, R. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Oct 1974. 20p. (CONF-741079-17). Dep. NTIS $4.00.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

The production of thermonuclear energy, by laser driven implosion of spherical DT shells, with achievable laser technology, requires the development of an efficient and stable implosion. Certain aspects of the acceleration of the spherical shells can be studied experimentally by irradiating thin, 5 to 25 mu m, polyethelene foils. The results of foil acceleration experiments performed using a Nd:YAG-Glass laser capable of producing 150 J, 1 nsec pulses will be discussed. The dynamics of the accelerated foil, the ion blow off, high energy electron spectrum (6 to 180 keV), x-ray spectrum (1 to 150 keV) the spatial distribution of the x-ray emission, the laser beam focal spot energy distribution, the laser temporal pulse shape and spectrum for reflected and transmitted radiation have all been measured simultaneously. The results of these measurements are compared with detailed numerical simulations. (auth)

22141 (UCRL-76350) VALKYRIE, A CO_2 LASER SYSTEM FOR LASER FUSION EXPERIMENTS. Manes, K. R.; Lindquist, W. B.; Renard, P. A.; Eddleman, H. E.; Smith, D. L.; Glaros, S. S.; Stewart, T. C.; Haas, R. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1975. 45p. (CONF-750520-10). Dep. NTIS $5.25.

From IEEE Optical Society of American conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

A short-pulse CO_2 laser system fabricated from commercially available components for laser fusion experimentation is described. Simulation calculations are sketched, amplifier testing is discussed, overall laser system performance is reported and the requirements for a typical target irradiation experiment are described. (auth)

Plasma Stability

Refer also to abstract 22098.

22142 (IPP-1/153) FINITE-β STABILIZATION OF A DIFFUSE HELICAL l = 1 MHD EQUILIBRIUM. Herrnegger, F.; Nuehrenberg, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Apr 1975. 22p. Dep. NTIS (US Sales Only) $4.00.

The stability of helically symmetric finite-β, l = 1 magnetohydrostatic equilibria with arbitrary pressure profile and vanishing longitudinal current is investigated by means of Mercier's criterion, a sufficient criterion by Lortz, Rebhan and Spies, and Shafranov's condition for a high-β magnetic well. The new finite-β effects are that (1) a magnetic well is created throughout the plasma region for $0.2 \lesssim \beta \lesssim 0.95$ and $0.3 \leq a\tau \leq 0.6$ (a plasma radius, τ torsion of the magnetic axis); (2) the mean magnetic well extends out into the vacuum region for $0.75 \lesssim \beta$ and $b\tau \lesssim 0.6$ (b wall radius); (3) with the exception of a very narrow region ($<0.1\ a\tau$) around the magnetic axis, the Mercier criterion is satisfied for $0.75 \lesssim \beta \lesssim 0.95$ and $0.12 \lesssim a\tau \lesssim 0.3$. (auth)

22143 (IPP-6/133) NEW MACROSCOPIC THEORY OF ANOMALOUS DIFFUSION INDUCED BY THE DISSIPATIVE TRAPPED-ION INSTABILITY. Wimmel, H. K. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 36p. Dep. NTIS (US Sales Only) $5.00.

For an axisymmetric toroidal plasma of the TOKAMAK type a new set of dissipative trapped-fluid equations is established. In addition to $E \times B$ drifts and collisions of the trapped particles, these equations take full account of the effect of $E_{||}$ (of the trapped ion modes) on free and trapped particles, and of the effect of $\nabla\delta_0$ (δ_0 = equilibrium fraction of trapped particles). From the new equations the linear-mode properties of the dissipative trapped-ion instability and the anomalous diffusion flux of the trapped particles are derived. (auth)

22144 (LBL-3267) PARAMETRIC INSTABILITIES IN INHOMOGENEOUS PLASMA. Nicholson, D. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 6 Jun 1975. Contract W-7405-ENG-48. 111p. Dep. NTIS $8.75.

Thesis.

The nonlinear coupling of three waves in a plasma is considered. One of the waves is assumed large and constant; its amplitude is the parameter of the parametric instability. The spatial-temporal evolution of the other two waves is treated theoretically, in one dimension, by analytic methods and by direct numerical integration of the basic equations. Various monotonic forms of inhomogeneity are considered; agreement with previous work is found and new results are established. Nonmonotonic inhomogeneities are considered, in the form of turbulence and, as a model problem, in the form of a simple sinusoidal modulation. Relatively small amounts of nonmonotonic inhomogeneity, in the presence of a linear density gradient, are found to destabilize the well-known convective saturation, absolute growth occurring instead. (auth)

22145 PHYSICAL MECHANISM OF PARAMETRIC INSTABILITIES NEAR THE LOWER-HYBRID FREQUENCY IN INHOMOGENEOUS PLASMA. Porkolab, M. (Princeton Univ., NJ). pp 41-49 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

The dispersion relation for parametric instabilities near the lower-hybrid frequency is obtained from model fluid equations. The following instabilities are discussed: for rf pump frequencies $\omega_0 \gtrsim 3\omega_{LH}$, $\omega_{pe} \simeq \Omega_e$, resonant decay into ion sound (ion cyclotron) modes (previously predicted) is found. In the regime of $1 \gtrsim \omega_0/\omega_{LH} \gtrsim 3$, $\omega_{pe} \simeq \Omega_e$, decay into ion quasi-modes is found. In strong magnetic fields decay into quasi-modes is also found for $3 \gtrsim \omega_0/\omega_{LH}$. This mechanism is similar to nonlinear Landau damping in weak turbulence theory. In addition, decay into the purely growing mode and fluid-quasi modes may also occur. The results are compared with recent calculations from the Vlasov equation. The effects of plasma-inhomogeneities will also be considered, including effective thresholds due to density gradients and finite pump extent. The implications of these results to rf heating of tokamaks near the lower-hybrid frequency are discussed. (auth)

22146 PARAMETRIC EXCITATION OF ELECTROSTATIC INSTABILITIES BY A WHISTLER WAVE. Harms, K. D.; Hasselberg, G.; Rogister, A. (Kernforschungsanlage, Juelich, Ger.). pp 125-126 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969–.

Parametric excitation of electrostatic instabilities in a magnetized plasma is considered in the frequency range between the ion cyclotron and the lower hybrid frequency with plasma modes propagating nearly orthogonal to the main magnetic field ($k_z \ll k_\perp$) with wavelengths between the electron and ion gyroradius. The pump wavelength is assumed large compared to the mode wavelength ($k_0 \ll k$) but with the possibility of comparable parallel wavelength. (auth)

22147 FLUID PICTURE OF THE PARAMETRIC INSTABILITY NEAR THE LOWER HYBRID FREQUENCY. Bornatici, M. (Univ. of Calabria, Cosenza, Italy). pp 127 of Symposium on Plasma

Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The instability of a plasma in the presence of a long-wavelength electric field oscillating near the lower hybrid frequency is described by means of the two fluid equations. It is shown that the coupling mechanism which drives short-wavelength lower hybrid waves and ion acoustic waves is due to the convective term of the electron continuity and momentum equation, respectively. (auth)

22148 EXPERIMENTAL OBSERVATIONS ON THE INTERACTION BETWEEN A LOW FREQUENCY INSTABILITY AND A RF FIELD NEAR THE LOWER HYBRID RESONANCE. Moresco, M.; Zilli, E. (Association EURATOM-CNR, Padua). pp 128-133 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The experiments were performed in a stationary plasma column produced by a microwave source (of the type of the Lisitano coil) in a magnetic field. The main experimental parameters are density $\sim 10^{10}$ cm^{-3}, B $\simeq$ 850 G, neutral gas (helium) pressure $\sim 10^{-3}$ torr, $T_e \sim 5$ eV; the column dimensions are about 1.5 m in length, 7 cm in diameter. Two triaxial probes, movable in the radial and asimuthal direction respectively, are used to detect fluctuations in the plasma and also as Langmuir probes. In order to properly detect potential fluctuations the probe signal is fed into a very high input impedence device, which drives the inner probe shield in phase (in order to present a high a.c. impedance to the plasma) and has a very low output impedance. The electron density is also measured by a microwave interferometer. (auth)

22149 COLLECTIVE MODES IN A BEAM INJECTED PLASMA. Coppi, B. (Massachusetts Inst. of Tech., Cambridge); Bhadra, D.; Sleeper, A. pp 159-165 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

The effects of microinstabilities, which are excited in a confined plasma characterized by two ion components, e.g. a high temperature deuterium component and a low temperature tritium component, are investigated. The relevant growth rates depend on the radial temperature gradient or the radial density gradient of the hot ion population. The main consequences of the excited modes can be the extraction of energy from the hot ion component, the scattering of weakly trapped and weakly circulating orbits for the same component, and the enhancement of the particle and thermal energy transport across the magnetic field for all ion and electron populations. (auth)

22150 MICROINSTABILITY THEORY FOR TOROIDAL PLASMA HEATED BY INTENSE ENERGETIC ION BEAMS. Berk, H. L.; Horton, W. Jr.; Rosenbluth, M. N.; Rutherford, P. H. (Princeton Univ., NJ). pp 182-188 of Symposium on Plasma Heating in Toroidal Devices. Bologna; Editrice Compositori (1974).

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974). See CONF-740969-.

A survey is given of possible microinstabilities in two-component neutral-injection-heated tokamaks. It is concluded that infinite-medium velocity-space modes should be quite strongly stable, and possible instabilities of the shear-Alfvén finite-medium modes should be localized to near the axis. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstracts 21924 and 22228.

22151 (BNL-16580) COST OF MAGNETS FOR LARGE FUSION POWER REACTORS: PHASE I, COST OF SUPERCONDUCTORS FOR DC MAGNETS. Powell, J. R. (Brookhaven National Lab., Upton, N. Y. (USA)). 25 Feb 1972. 283p. Dep. NTIS $17.25.

Projections are made for dc magnet conductor costs for large fusion power reactors. A mature fusion economy is assumed sometime after 2000 A. D. in which approximately 90,000 MW(e) of fusion reactors are constructed/year. State of the art critical current vs. field characteristics for superconductors are used in these projections. Present processing techniques are used as a basis for the design of large plants sized to produce approximately one-half of the conductor needed for the fusion magnets. Multifilamentary Nb-Ti, Pb-Bi in glass fiber, GE Nb_3Sn tape, Linde plasma sprayed Nb_3Sn tape, and V_3Ga tape superconductors are investigated, together with high purity aluminum cryoconductor. Conductor costs include processing costs [capital (equipment plus buildings), labor, and operating] and materials costs. Conductor costs are compared for two sets of material costs: current (1971 A. D.) costs, and projected (after 2000 A. D.) costs. (auth)

22152 (BNL-19565) PRELIMINARY REFERENCE DESIGN OF A FUSION REACTOR BLANKET EXHIBITING VERY LOW RESIDUAL RADIOACTIVITY. Powell, J. R. (ed.). (Brookhaven National Lab., Upton, N. Y. (USA)). 1 Dec 1974. 114p. Dep. NTIS $8.75.

The following topics are described: (1) overview of the low activity blanket design, (2) plasma confinement, (3) fuel injection, (4) plasma heating, (5) mechanical features of the very low blanket and shield, (6) neutron activation and breeding, (7) blanket cooling, (8) electricity generation, (9) recovery of spent fuel and plasma exhaust, (10) recovery of bred tritium, (11) blanket replacement and processing, and (12) effluents during normal operation and emergency containment. (MOW)

22153 (BNL-20075) INTENSE NEGATIVE HYDROGEN ION SOURCE FOR NEUTRAL INJECTION INTO TOKAMAKS. Prelec, K.; Sluyters, T. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 4p. (CONF-750905-17). Dep. NTIS $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

A magnetron type ion source was constructed for the production of intense negative hydrogen beams. With six emission slits, beam currents in excess of 0.6 A were achieved in beam pulses of 10 ms for an extractor voltage of 15 kV. (auth)

22154 (BNL-20159) PROPOSAL FOR AN ACCELERATOR-BASED NEUTRON GENERATOR. Grand, P. (ed.). (Brookhaven National Lab., Upton, N. Y. (USA)). Jul 1975. 160p. Dep. NTIS $11.00.

An Accelerator-based Neutron Generator is described that consists of a 30-MeV deuteron linear accelerator using a flowing liquid lithium target. With a continuous deuteron current of 100 milliamperes, a source intensity of more than 10^{16} neutrons per second will be produced. The neutrons will be emitted in a roughly collimated beam. The proposed facility can be divided into two areas: the 30-MeV linear accelerator and the multiple-target experimental area. The 30-MeV accelerator will consist of eight rf accelerating cavities in a single vacuum tank, each cavity being powered by its own rf power amplifier operating at 50 MHz. To shield the beam bunches from the rf field when it is in the decelerating direction, 66 "drift tubes" will be included; the drift-tube structures will include quadrupole magnets which will keep the beam focused. The accelerator will produce a continuous beam of 100 milliamperes. Beam power will thus be 3.0 megawatts; total power including rf losses in the accelerating cavities will be 4.5 megawatts. The injectors for the linear accelerator will be two 500-kV dc accelerators, one for injection of D^+ ions and the other for D^- ions. They can be used simultaneously or one can serve as a spare in case of breakdown or maintenance of the other. (MOW)

22155 (BNL-20234) STATUS REPORT ON CONTROLLED NUCLEAR FUSION AS A SOURCE OF HYDROGEN ENERGY. Powell, J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 45p. (CONF-750334-2). Dep. NTIS $5.25.

From symposium on hydrogen energy fundamentals; Miami Beach, Florida, USA (3 Mar 1975).

The present status of controlled fusion research is reviewed. Possible future research is also described. Tokamak systems using both fusion and fissionable fuels are discussed. Various aspects of hydrogen production by fusion reactors are described according to cost and economics. (MOW)

22156 (BNL-20299) BERYLLIUM AND LITHIUM RESOURCE REQUIREMENTS FOR SOLID BLANKET DESIGNS FOR FUSION REACTORS. Powell, J. R. (Brookhaven National Lab., Upton, N. Y. (USA)). 31 Mar 1975. 16p. Dep. NTIS $4.00.

The lithium and beryllium requirements are analyzed for an economy of 10^6 MW(e) CTR capacity using solid blanket fusion reactors. The total lithium inventory in fusion reactors is only approximately 0.2 percent of projected U. S. resources. The lithium inventory in the fusion reactors is almost entirely ^{6}Li, which must be extracted from natural lithium. Approximately 5 percent of natural lithium can be extracted as ^{6}Li. Thus the total feed of natural lithium required is approximately 20 times that actually used in fusion reactors, or approximately 4 percent of U. S. resources. Almost all of this feed is returned to the U. S. resource base after ^{6}Li is extracted, however. The beryllium requirements are on the order of 10 percent of projected U. S. resources. Further, the present cost of lithium and the cost of beryllium extraction could both be increased tenfold with only minor effects on CTR capital cost. Such an increase should substantially multiply the economically recoverable resources of lithium and beryllium. It is concluded that there are no lithium or beryllium resource limitations preventing large-scale implementation of solid blanket fusion reactors. (auth)

22157 (CONF-750718-1) ISX TOKAMAK AS A RADIATION TEST FACILITY FOR SURFACE STUDIES. Colchin, R. J.; Jernigan, T. C.; Schaffer, M. J. (Oak Ridge National Lab., Tenn. (USA); General Atomic Co., San Diego, Calif. (USA)). 30 Jun 1975. 16p. Dep. NTIS $4.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

ISX (Impurities Study Experiment) is a moderate-sized tokamak facility dedicated to the study of the origin and transport of impurities. This machine is expected to approximate the plasma conditions in the outer layer of a large ohmically heated device, except for neutron effects. The deposition of impurities and limiter material from the walls will be studied by using AES, SIMS, and soft x-ray appearance potential spectroscopy. Chemical reactions with atomic hydrogen, as well as desorption by electrons, ions, and uv radiation, will be studied to determine the evolution of wall material into the plasma. UV spectroscopic and x-ray methods will be used to determine impurity-plasma transport. ISX is designed so that liners may be interchanged easily and quickly. This allows for testing different wall and limiter materials, such as honeycomb walls, with a turnaround of a few weeks. Initial tests will determine the effectiveness of baking and discharge cleaning in attaining clean surfaces. The parameters of the machine are: r equals 25 cm, R equals 90 cm, B/sub T/ equals 18 kG, and I/sub p/ equals 150 kA for q equals 4. Expected plasma parameters are T/sub e/ equals 500 to 1000 eV, T/sub i/ equals 300 to 500 eV, and n/sub e/ equals 2 to 7 x 10^{13} cm^{-3}. (auth)

22158 (CONF-750723-9) LARGE-VOLUME INTENSE NEUTRON SOURCE FOR CTR MATERIALS STUDIES. Saltmarsh, M. J.; Horak, J. A. (Oak Ridge National Lab., Tenn. (USA)). 1975. 19p. Dep. NTIS $4.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

The measurement of bulk radiation effects for the CTR program will require the irradiation of many hundreds of samples by energetic neutrons to fluences in excess of 10^{21} n/cm^2. The environment of the samples must be well controlled, particularly as regards temperature and stress. There must be easy access for instrumentation and remote handling, and provision for pulsed operation may be required. A facility based on a 30 to 40 MeV 100 mA deuteron linac and a liquid lithium jet target appears to offer the best combination of intensity, experimental volume, energy spectrum and experimental access. The linear accelerator would be of the Alvarez type designed for high transmission efficiency and reliability and to take advantage of existing high power rf technology. The injector would be based on the Oak Ridge work with high current dc ion sources. Existing liquid metal technology appears adequate for the target design. (auth)

22159 (ERDA-tr-58) EXPERIMENTAL THERMONUCLEAR DEVICE "TOKAMAK-20." Volumes 1 and 2. Kurchatov, I. V.; Yefremov, D. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1975. Translated from Russian. 169p. Dep. NTIS $7.60.

T-20 is an experimental thermonuclear device designed for the study of the physical processes in a plasma with thermonuclear parameters ($n\tau_E \approx 10^{14}$ cm^{-3} sec, T > 7 keV) and permitting prolonged operation under the conditions of a deuterium-tritium experiment. In addition to solving physical problems, the T-20 device permits the simulation and selection of the principal engineering solutions that must be used in working out the design of a thermonuclear power reactor based on the Tokamak. The main parameters of the device (dimensions of the plasma and current flowing through it, input power of the device and additional heating methods) are chosen so that a powerful thermonuclear reaction takes place in the deuterium-tritium plasma with an energy released in neutrons on the scale of the energy introduced into the plasma. The plasma parameters ($n\tau_E$ and T) in the T-20 are practically the same as those necessary for the hybrid Tokamak reactor with a uranium blanket and can be directly extrapolated (without an intermediate step) to a "clean" power reactor. (auth)

22160 (IFA-FR-131-1975) THEORETICAL CONSIDERATIONS CONCERNING THE SIZE OF THERMONUCLEAR PLASMA CORE OF THE THERMONUCLEAR REACTOR CONTROLLED BY THE RATE OF THE NUCLEAR FISSION REACTIONS. Part I. Cristea, G. (Comitetul de Stat pentru Energia Nucleara, Bucharest (Romania)). May 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

An elementary model is presented of the thermonuclear plasma doped with impurities. An endeavor is made to achieve the energy balance through the fusion action so as to be able to estimate the size of the high temperature plasma and thence the power of the thermonuclear reactor. The manner is discussed of obtaining the mean energy necessary to produce a fusion act by a deuterium or tritium and deuterium ion finally. The values are brought into relief of the time constants during which the various ionic components of the plasma receive or yield energy. Some characteristic quantities of the high temperature plasma are computed for four types of potential thermonuclear reactors and all directions are discussed towards which the research should be directed in view of elucidating the principal problems of this type of thermonuclear reactor. (auth)

22161 (IFA-FR-132-1975) THEORETICAL CONSIDERATIONS CONCERNING THE SIZE OF THERMONUCLEAR PLASMA CORE OF THE THERMONUCLEAR REACTOR CONTROLLED BY THE RATE OF THE NUCLEAR FISSION REACTIONS. Part II. Cristea, G. (Comitetul de Stat pentru Energia Nucleara, Bucharest (Romania)). 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

An elementary model is presented of the thermonuclear plasma doped with impurities. The mean energy necessary to produce a fusion reaction by deutrium or tritium and deuterium is discussed. The values are brought into relief of the time constants during which the various ionic components of the plasma receive or yield energy. Some characteristic quantities of the high temperature plasma are computed for four types of potential thermonuclear reactors. (auth)

22162 (IFA-FR-134-1975) USE OF CODE DTF-4 FOR DETERMINING THE COEFFICIENT OF BACK-REFLECTION OF THE NEUTRON WITHIN THE THERMONUCLEAR PLASMA OF A THERMONUCLEAR REACTOR CONTROLLED BY THE RATE OF THE FISSION REACTIONS. Part I. Cristea, G. (Comitetul de Stat pentru Energia Nucleara, Bucharest (Romania)). Jun 1975. 9p. Dep. NTIS (US Sales Only) $4.00.

The neutron problems are discussed of the thermonuclear reactor controlled by the rate of the fission reactions. The results obtained by rolling the DTF-4 program in a spherical geometry in the case of an "external source" problem permit one to draw conclusions concerning the problems of the neutronics system of this thermonuclear reactor type. A relation is deduced for estimating the coefficient of back-reflection of the neutrons within the thermonuclear plasma and the focusing system is discussed of the neutronics of this reactor type. (auth)

22163 (IPP-4/127) SPECIAL CONSIDERATIONS IN THE DEVELOPMENT OF FAST SWITCHING SL/NL CURRENT BREAKERS (CRYOTRONS). Pillsticker, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Dec 1974. 47p. (In German). Dep. NTIS (US Sales Only) $5.50.

Special technical problems of fast switching SC/NC current breakers (cryotrons) are reported. At first typical requirements for these breakers are defined. The importance of specific parameters, for instance relations between ohmic resistance of superconductors, temperature, and materials, as well as parameters affecting the switching time, for example trigger energy and electrical conditions of the trigger circuit are explained. The stability of the breaker material in the superconductive state is considered in general, while constructive possibilities bearing upon the stability are discussed more exactly. Problems of dimensioning taking notice of important facts are reported and formal relations are given. The special possibilities of triggering a breaker are discussed. Advantages and disadvantages of triggering by current-pulse and magnetic field pulse are explained, because these are the methods for triggering fast switching breakers. Some breaker concepts are given, which may be suitable as the fundaments of large fast switching breakers. By connecting these parts in parallel and/or in series one is able to switch very high currents, the resistance of the breaker can be changed as necessary, and the breakdown voltage of a breaker may be very high. (auth)

22164 (LA-UR-75-1232) CAPACITOR REQUIREMENTS FOR CONTROLLED THERMONUCLEAR EXPERIMENTS AND REACTORS. Boicourt, G. P.; Hoffman, P. S. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 21p. (CONF-750723-5). Dep. NTIS $4.25.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

Future controlled thermonuclear experiments as well as controlled thermonuclear reactors will require substantial numbers of capacitors. The demands on these units are likely to be quite severe and quite different from the normal demands placed on either present energy storage capacitors or present power factor correction capacitors. It is unlikely that these two types will suffice for all necessary Controlled Thermonuclear Research (CTR) applications. The types of capacitors required for the

various CTR operating conditions are enumerated. Factors that influence the life, cost and operating abilities of these types of capacitors are discussed. The problems of capacitors in a radiation environment are considered. Areas are defined where future research is needed. Some directions that this research should take are suggested. (auth)

22165 (LA-UR-75-1247) LTPF: A LINEAR THETA-PINCH NEUTRON SOURCE. Ellis, W. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 46p. (CONF-750723-7). Dep. NTIS $5.50.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

The linear theta pinch is optimized with respect to maximum neutron current on a sample located between the discharge tube and the compression coil wall. Emphasis throughout is placed on physics and technology considerations which govern the choice of parameters. Technological demands are (hopefully) kept to a minimum. Two "point designs" are developed which are distinguished by their compressional magnetic field (i.e., coil current) waveforms: one is sinusoidal and continuous, the other trapezoidal and pulsed intermittently. Both point designs give an average neutron current of approximately 5×10^{13} n/cm^2/s. Both devices are characterized by short lengths (approximately 1 m), rapid cycling (2 to 30 kHz), and magnetic mirrors (2 to 5:1) at the ends. A crucial item is the power supply, which is discussed in detail. (auth)

22166 (LA-UR-75-1262) INTENSE NEUTRON SOURCE FACILITY FOR THE FUSION ENERGY PROGRAM. Armstrong, D. D.; Emigh, C. R.; Meier, K. L.; Meyer, E. A.; Schneider, J. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 51p. (CONF-750723-8). Dep. NTIS $5.75.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

The intense neutron source is based on the ability of a supersonic flow of gas to dissipate an enormous quantity of heat generated in the neutron-producing target by multiple Coulomb collisions. A description is given of the principles involved in forming the supersonic jet, in forming the intense tritium-ion beam, in the vacuum systems, and in the tritium handling systems. An overview of the entire facility is included. It is believed that the facility can be operated with high reliability, ensuring a productive radiation damage program. (MOW)

22167 (ORNL-TM-4958) CALCULATION OF MAGNETIC FIELDS FROM TIME-VARYING CURRENTS IN THE PRESENCE OF CONDUCTORS. Dodd, C. V.; Deeds, W. E. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 40p. Dep. NTIS $5.00.

Equations were derived for the magnetic field for the case of a cylindrically symmetric coil of rectangular cross section being driven by a sinusoidal current above conducting plates. Computer programs were written to numerically evaluate these equations. The most general program calculates the field for a coil above multiple (up to 9) plates, each having any resistivity and thickness. The field is calculated anywhere in or behind the conductors, and for five different values of coil-to-conductor spacing. The total eddy-current power dissipated in the conductors is also calculated, as well as the magnetic field at the center of the coil. The calculations agree with calculations and experimental measurements performed by others, although only a few cases could be compared. Equations were also derived for the Fourier analysis of pulses, the power density, and the eddy-current force density; but no programs were written for these. (auth)

22168 (SAND-75-5442) PULSED NEUTRON SOURCES FOR FUSION REACTOR MATERIALS STUDIES. Teopfer, A. J.; Martin, T. H.; Clauser, M. J.; Swain, D. W.; Beckner, E. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 18p. (CONF-750723-2). Dep. NTIS $4.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

Pulsed neutron sources for fusion reactor materials studies which use intense D_2 ion beams to irradiated tritiated targets, and intense relativistic electron beams to implode DT filled targets to thermonuclear burn are described. In present accelerators, high current ion beams are produced by space-charge limited emission from the anode plasma in vacuum diodes. Using deuterated electrodes, greater than 10^9, neutrons (2.5 MeV) have been produced from the D(d,n)He^3 reaction, without optimization of the diodes for ion beam production on a 400 kV, 8 kJ (5×10^{10} W) accelerator. The use of diodes designed to enhance the fraction of energy carried by the ion beam, and utilizing microsecond-pulse diodes, could lead to at least an order of magnitude enhancement in the neutron yield. With no enhancement, scaling of present results to a 10^{13} W accelerator operating at 1.5 MV with tritiated electrodes, results in estimated neutron yields greater than 10^{12} n/pulse in the 1976 to 1977 time frame. The use of intense relativistic electron beams to ignite inertially confined thermonuclear fuel will produce approximately 10^{13} n/pulse with beams generated from a 4×10^{13} W accelerator in 1980 to 1981. A substantial gain in output to approximately 10^{17} n/pulse should be available in the CY 1983 time frame from a projected 10^{14}W accelerator. (auth)

22169 (SAND-75-5772) LARGE AREA SOLID TARGET NEUTRON SOURCE. Crawford, J. C.; Bauer, W. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). 1974. 22p. (CONF-750723-10). Dep. NTIS $4.25.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

A potentially useful neutron source may result from the combination of a solid deuterium-tritium loaded target with the large area, high energy ion beams from ion sources being developed for neutral beam injection. The resulting neutron source would have a large radiating area and thus produce the sizable experimental volume necessary for future studies of bulk and synergistic surface radiation effects as well as experiments on engineering samples and small components. With a 200 keV D^+ T^+ beam and 40 kW/cm^2 power dissipation on a 200 cm^2 target spot, a total neutron yield of about 4×10^{15} n/sec may be achieved. Although the useable neutron flux from this source is limited to 1 to 2 x 10^{13} n/cm^2/sec, this flux can be produced 3 cm in front of the target and over about 300 cm^3 of experimental volume. Problems of total power dissipation, sputtering, isotopic flushing and thermal dissociation are reviewed. Neutron flux profiles and potential experimental configurations are presented and compared to other neutron source concepts. (auth)

22170 (UCID-16821) TRANSPORT OF ION BEAMS BY MAGNETIC FIELDS ON THE BEAM EDGES. Hooper, E. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Jun 1975. Contract W-7405-Eng-48. 19p. Dep. NTIS $4.00.

The transport of low energy ion beams (less than 10 keV) by magnetic fields on the edge of the beam is analyzed. Calculations indicate that beams with low transverse temperature can be transported. (auth)

22171 (UCID-16849) DT FUSION NEUTRON IRRADIATION OF ANL ELECTRON MICROSCOPY SAMPLES. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jul 1975. Contract W-7405-Eng-48. 6p. Dep. NTIS $4.00.

The experimental parameters for irradiating the above specimens with 14-MeV neutrons from the LLL Rotating Target Neutron Source are described. No test results are given. (MOW)

22172 (UCID-16850) DT FUSION NEUTRON IRRADIATION OF LASL YAG, SPINEL, AND ALUMINA SAMPLES, LLL SUPRACIL, LLL MOLYBDENUM AND LLL PHOTON INTERRUPTER. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jul 1975. Contract W-7405-Eng-48. 9p. Dep. NTIS $4.00.

The experimental parameters for irradiating the above specimens with 14-MeV neutrons from the LLL Rotating Target Neutron Source are described. No test results are given. (MOW)

22173 (UCID-16873) DT FUSION NEUTRON IRRADIATION OF BPNL NIOBIUM. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jul 1975. Contract W-7405-Eng-48. 6p. Dep. NTIS $4.00.

The experimental parameters for irradiating the above specimen with 14-MeV neutrons from the LLL Rotating Target Neutron Source are described. No test results are given. (MOW)

22174 (UCRL-13639(Vol.1)) LASER FUSION STUDY. Final Report, Volume I, Study Results. (Hughes Aircraft Co., Culver City, Calif. (USA)). Jun 1975. 313p. Dep. NTIS $18.75.

For Univ. of California, Livermore.

The primary goal of this study was to devise, evaluate, and conceptually design a complete, end-to-end, alignment system capable of handling 30 to 32 Shiva amplifier chains to specified accuracies in space and time. A secondary goal was to accomplish the primary goal with an acceptably low development and procurement cost and with an acceptably high day-after-day performance reliability. This report presents such a system: it is comprised of sensors, actuating mechanisms, controls, and displays that perform well within the current art-state. (MOW)

22175 (UCRL-50016-75-2, pp 1-2) DEVELOPMENT OF HIGH-FIELD SUPERCONDUCTORS FOR FUSION RESEARCH. 1975.

In mechanical engineering department. Quarterly report: April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

A program to develop large-cross-section multifilamentary Nb_3Sn superconductors that can be used in the construction of CTR magnets is described. Multifilamentary Nb_3Sn superconductors with more than 660,000 filaments have been tested in fields as high as 13.5 T and have carried currents up to 10,000 A. Further tests are planned on coiled superconductors. (auth)

22176 (UCRL-50016-75-2, pp 12-16) MEASUREMENT OF LASER-FUSION TARGET CAPSULES USING THE INTERFEROMETRIC METHOD OF EXCESS FRACTIONS. 1975.

In mechanical engineering department. Quarterly report: April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

The calculations show that it is possible to measure the average wall thickness of transparent laser-fusion target capsules to 0.5 percent, wall uniformity to 0.3 percent, and gas fill to 3 percent. The method is not limited to laser targets; it can be used for many types of measurements where high magnifications and accuracy are required. Preliminary experimental tests have been conducted to verify the validity of the proposed method and its anticipated accuracy. (auth)

22177 (UCRL-76856) LIVERMORE INTENSE NEUTRON SOURCE: DESIGN CONCEPTS. Davis, J. C.; Anderson, J. D.; Booth, R.; Logan, C. M.; Osher, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1975. 39p. (CONF-750723-6). Dep. NTIS $5.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

The Lawrence Livermore Laboratory proposes to build an irradiation facility containing several 14 MeV T(d,n) neutron sources for materials damage experimentation. The sources will operate as a national facility for CTR materials damage studies under the auspices of the Materials and Radiation Effects Branch of the Division of Controlled Thermonuclear Research. A source strength of 4×10^{13} n/s can be produced with 400 keV D^+ beam on the tritium in titanium target system now used on the Livermore Rotating Target Neutron Source (RTNS). To produce the desired source strength an accelerator which can deliver 150 mA of 400 keV D^+ ions must be built. For the target to remain within the time-temperature regime of the present system it must have a diameter of 46 cm and rotate at 5000 rpm. With a beam spot 1 cm fwhm the useful target lifetime is expected to be the 100 hours typical of the present system. A maximum flux of 1.5×10^{13} n/cm^2 s will be attainable over a sample 1 mm thick by 8 mm in diameter. Each accelerator will use a Cockcroft–Walton HV supply with high speed diodes, a multiple aperture ion source with pre-acceleration species selection, and a short, uniform gradient acceleration tube. The beam transport system from accelerator to target will accommodate a considerable amount of residual space charge on the 400 keV beam. Development of the 5000 rpm differentially pumped air bearing seal for the target system is complete. Prototype targets with internal water cooling have operated at 5000 rpm using this seal. Advanced target development may allow the accelerators to be upgraded to 400 mA current, providing source strengths above 10^{14} n/s. The neutron sources will be supported by a laboratory building providing mechanical, electronic, computer, dosimetry, and materials handling services for the users of this facility. Facility subsystems will allow rapid retrieval of experimental apparatus for sample changes and have extensive data logging capability for in-situ measurements. (auth)

22178 (UCRL-76857) CHARACTERISTICS OF ROTATING TARGET NEUTRON SOURCE AND ITS USE IN RADIATION EFFECTS STUDIES. Van Konynenburg, R. A.; Barschall, H. H.; Booth, R.; Wong, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1975. 17p. (CONF-750718-2). Dep. NTIS $4.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

The Rotating Target Neutron Source (RTNS) at Lawrence Livermore Laboratory is currently the most intense source of DT fusion neutrons available for the study of radiation effects in materials. This paper will present a brief description of the machine, outline the history of its development and discuss its performance characteristics and its application to CTR materials research. (auth)

22179 (UCRL-76881) MIRROR FERF. Moir, R. W.; Taylor, C. E.; Doggett, J. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Aug 1975. 13p. (CONF-750725-12). Dep. NTIS $4.00.

From international solvent extraction conference; The Hague, Netherlands (19 Apr 1971).

This paper describes an up-dated version of the small mirror reactor for a Fusion Engineering Research Facility (FERF) and describes the present status of technology development and the goals required for the magnet, neutral beam injectors, plasma start-up, and remote handling operations. The conventional mirror FERF design has a "Yin-Yang" minimum parallel bar B parallel bar magnetic well with plasma end-losses sustained by continuous injection of up to 500 A of neutral particles. Injection energy is 65 keV (D^0) and 97.5 keV (T^0). A "low-field" version, 3.75 T central vacuum field, produces 3.4 MW of fusion power and about 10^{14} n/cm^2 • s uncollided 14-MeV neutron current emanating from the plasma. (auth)

22180 PROBLEMS AND PROMISES OF CONTROLLED FUSION. Mills, R. G. ASME Publication 74-WA/NE-10. New York; American Society of Mechanical Engineers (1975). 9p. $3.00.

From winter annual meeting; New York, NY (17 Nov 1974).

Rapid progress has been made in understanding magnetically confined plasma, the approach to fusion power that seems closest to realization. The way now seems clear to the fabrication of the large experimental machines that will be necessary to establish scientific feasibility and pave the way to experimental reactors. A number of important problems remain to be resolved before controlled thermonuclear fusion can become a reality, but the goal is closely matched to our need to find a way to produce large quantities of power while conserving our resources and environment. Reasons for the current optimism are reviewed and one formulation of a complete power plant is presented. (auth)

22181 COMPARATIVE STUDY OF RADIOACTIVITY AND AFTERHEAT IN SEVERAL FUSION REACTOR BLANKET DESIGNS. Conn, R. W. (Univ. of Wisconsin, Madison); Sung, T. Y.; Abdou, M. A. Nucl. Technol.; 26: No. 4, 391-399(Aug 1975).

The induced radioactivity and afterheat in five recently presented fusion reactor blanket designs were calculated. These designs differ in the choices of structural material, coolant, and neutron multiplier. Nevertheless, the radioactivity levels at shutdown after a 2-yr operation are within a factor of 4 of each other and are clustered at approximately 1 Ci/W(th). However, the long-term radioactivity (greater than 200 yr) is greatest for niobium structures and least for aluminum. For niobium, the level of long-term activity is approximately 5×10^{-5} Ci/W(th), whereas for aluminum, the level drops to approximately 10^{-7} Ci/W(th) just several weeks after shutdown. This last result will be modified by the inclusion of trace elements and impurities. Afterheat levels are found to vary from ½ to 5 percent of the thermal operating power, depending on design and the choice of structural material. Importantly, however, the afterheat power density is only approximately 0.2 W/cm^3 at most and this is roughly a factor of 10 to 60 less than the afterheat power density in fast breeder reactors. Biological hazard potential (BHP) values are calculated for all designs by the pessimistic approach of dividing the activity in Ci/kW(th) by the lowest maximum permissible concentration value, in Ci/km^3 of air, given in U. S. Atomic Energy Commission rules, Title 10, Part 20. In all cases, the BHP nevertheless drops below 1 km^3/kW(th) 20 yr after shutdown following a 2-yr operation. The key isotopes contributing to radioactivity, afterheat, and BHP are listed for future reference. (auth)

22182 FUSION DESIGN STUDY OF NONMOBILE BLANKETS WITH LOW LITHIUM AND TRITIUM INVENTORIES. Abdou, M. A. (Argonne National Lab., IL); Wittenberg, L. J.; Maynard, C. W. Nucl. Technol.; 26: No. 4, 400-419(Aug 1975).

Developing a controlled thermonuclear reactor blanket that minimizes lithium and tritium inventories is feasible. The tritium inventory is minimized by keeping the lithium inventory to a minimum and utilization of a lithium-bearing compound with low retention for tritium and an efficient tritium extraction system. The lithium inventory is minimized by employing a thin layer of ^{6}Li operating in a soft neutron spectrum obtained by slowing down the deuterium-tritium (DT) neutrons in beryllium. Material properties and performance such as tritium retention, irradiation characteristics, and chemical compatibility of possible lithium-bearing materials and beryllium compounds have been evaluated. The blanket of the conceptual fusion reactor UWMAK-II uses stainless steel for first wall and structure, helium coolant, lithium aluminate enriched to 90 percent ^{6}Li for tritium breeding, metallic beryllium for neutron multiplication and moderation, and graphite for reflection and additional neutron moderation. A breeding ratio of 1.18 and nuclear heating of 18 MeV per DT neutron are obtained. The lithium inventory is only 4×10^4 kg (40 Mg). The steady-state inventory of tritium in the breeder is only 40 g, which is more than two orders of magnitude lower than that in blankets using lithium for cooling and neutron moderation as well as tritium breeding. Tritium leakage to the steam is kept to approximately 1 Ci/day by oxidation of the tritium in the helium coolant and absorption by a molecular sieve dessicant. Plant reliability is improved and accidental tritium and energy release are minimized in the type of blankets examined in this study. (auth)

Wave Phenomena

Refer also to abstracts 22104 and 22105.

22183 ECHO IN SEMI-CONFINED PLASMA. Sitenko, A. G.; Pavlenko, V. N.; Zasenko, V. I. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 323-326(Feb 1975). (In Russian).

The events in a semi-confined electronic plasma are studied by the model of the electron mirror reflection from the plasma boundary that occurs at excitation in a certain point of the space of the 1 distance from the boundary of two oscillations of the electric field of ω_1 and ω_2 frequencies. The echo oscillations arise at the $\omega_3 = \omega_2 - \omega_1$ frequency and their maximum intensity is at the $l^1 = (\omega_2 + \omega_1/\omega_2 + \omega_1)l$ distance from the boundary. (auth)

ENGINEERING

Energy Conversion

Refer also to abstracts 22447, 22769, 23552, 23702, 23715, 23718, 23721, and 23725.

22184 (TID-24229, pp 32-41) PRELIMINARY DESIGNS FOR 100 WATT (e) ISOTOPE THERMIONIC ELECTRICAL POWER MODULES. Williams, E. W. (General Electric Missile and Space Div., Valley Forge, PA); Howard, R. C. Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Preliminary designs are presented for 100 W (e) isotope thermionic electrical power modules employing curium-244 and polonium-210 as isotopic fuels. The modules are to be used as basic power units, which in multiples, can supply spacecraft electrical power requirements in the 0.5 to 2 kW range. Module design criteria are outlined, design descriptions presented, and performance estimates summarized. (auth)

22185 (TID-24229, pp 207-228) COMPONENT DEVELOPMENT FOR EXTERNALLY HEATED CYLINDRICAL THERMIONIC CONVERTER. Wolk, B.; Raiklen, H. (Fairchild Hiller Corp., Farmingdale, NY). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The development, fabrication, and evaluation of the components for an externally heated cylindrical converter having an interelectrode spacing of 0.010-inch are described. The objective of the current program is the development of converter reliability and long term performance capability. Previous converters of the same basic geometry and size produced 5.9 w/cm^2 at an emitter temperature of 1600°C. The converter contains a 70 cm^2 tungsten emitter vapor deposited by hydrogen reduction of tungsten hexafluoride and an insulated niobium collector prepared by electrodeposition of niobium over an alumina coated niobium-1 zirconium coolant tube. The more novel developments include the tri-layer collector, electron beam welded nested type tantalum bellows and gas pressure bonded tantalum-alumina cylindrical seals. The fabrication of an alternative planar graded cermet metal-ceramic seal based on gas pressure bonding niobium-alumina cermet layers is described. Gas pressure bonding techniques were also employed in fabricating the "fuel"-emitter assembly by consolidating segmented tungsten "fuel" cores and bonding these in a tantalum cladding to the tungsten emitter. All converter components are joined by electron beam welding to provide maximum reliability of the envelope. Component evaluation and process control are summarized. (auth)

22186 (WANL-PR(CC)-45) COMPACT THERMOELECTRIC CONVERTER. Phase II-C. Quarterly Progress Report, 1 January 1969–31 March 1969. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 Apr 1969. 83p. (NYO-3584-14). Dep. NTIS $7.25.

Declassified 31 Aug 1973.

Progress during Jan. to April 1969 in developing methods for fabricating thermoelectric converters and in testing thermoelectric modules is reported. Twenty-four modules were tested. All continue to operate satisfactorily. (LCL)

22187 QUICK DISCHARGE CIRCUIT FOR PACER NUCLEAR POWER SUPPLY. Chen, C. Y. (to American Optical Corp.). US Patent 3,885,572. 27 May 1975. Filed date 30 Nov 1973. 6p.

A quick discharge circuit for a pacer's nuclear power supply is described. A pacer capable of implantation within the body of a patient and capable of being powered by at least one nuclear battery is disclosed. Voltage from a single nuclear battery is increased by a factor of about 25 to 30 in order to provide a voltage level adequate to power pacer circuitry. A restartable DC–DC converter is used for this purpose. But if the converter malfunctions the load voltage must be reduced below a certain level for the converter to be automatically restarted. The present invention relates to means for reducing the time from converter malfunction to resumption of converter operation in order to reduce the corresponding inoperative pacer time period. (Official Gazette)

22188 PLUTONIUM-238-FUELED CARDIAC PACEMAKER. Alais, M. (Compagnie Industrielle Des Telecommunications CIT-Alcatel, Bruyeres-le-Chatel, France); Berger, R.; Boucher, R.; Gasper, K. A.; Laurens, P. Nucl. Technol.; 26: No. 3, 307-319 (Jul 1975).

The isotopic cardiac pacemaker directly applies nuclear technology to the field of medicine. Developed in 1970, the Laurens-Alcatel Model 9000 Pacemaker is now being implanted in humans in strict accordance with procedures set down by various regulatory agencies. This paper is an interim report on the reliability tests (with the resultant data) that have been performed on the isotopic cardiac pacemaker. The theoretical data for the longevity of the isotopic generator are discussed, as are the results for resistance to shock and corrosion tests. Comparative data are also given on the energy density of the isotopic generator and compared with other electrical power sources commonly used in cardiac pacing. The source thermal ^{238}Pu source has also been subjected to increasingly severe tests to ensure complete containment of all radioactive material. (auth)

Facilities and Equipment

Refer also to abstract 22250.

22189 (LA-tr-75-21) APPARATUS FOR THE THERAPEUTIC TREATMENT OF TUMORS WITH MICROWAVES. Fritz, K. 1 Jul 1960. Translation of German Patent No. 1,143,937. 5p. Dep. NTIS $4.00.

An apparatus for the therapeutic treatment of tumors with microwaves with the help of a puncture electrode equipped with a tubular middle conductor is characterized by the utilization of an injection liquid for the increase in the dielectrical loss. This is conveyed to the tumor tissue through the middle tubular conductor of the electrode and can be differentiated from those in the tissue by the high frequency electrical properties. This injection liquid also serves the purpose of limiting the conveyed microwave energy to the tumor. The apparatus is also characterized by a puncture electrode whose tubular middle conductor is forked on the free end which is to be used for puncturing. An alternating or rotary field is created between its two electrode points as a result. (WHK)

22190 (ORNL-SUB-2203-1) EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. Part 5a. Nonradial Nozzle at 22-1/2 Degrees 2.625 in. O. D.--2.500 in. I. D., Zero Penetration. Maxwell, R. L.; Holland, R. W. (Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering). Mar 1975. 175p. Dep. NTIS $11.75.

For Oak Ridge National Lab., TN.

A continuing series of investigations has been conducted to determine experimentally the stress patterns for the junction region of spherical shells with radially and non-radially attached nozzles when subjected to internal pressure and various types of loadings on the nozzles. Results of the investigations conducted on a non-radially attached nozzle of 2.625 in.-OD, 2.500 in.-ID and finished flush with the inner surface of the hemisphere are reported. The nozzle is inclined at 22½° from a radial axis. Stress values were determined for the following types of loading: internal pressure applied to the hemisphere and nozzle assembly; an axial load applied collinear with nozzle; and a pure torque applied in the radial plane of the nozzle. (LCL)

22191 (ORNL-SUB-2203-2) EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. Part 5b. Nonradial Nozzle at 22½ Degrees 2.625 in. O.D.–2.500 in. I.D., Zero Penetration. Maxwell, R. L.; Holland, R. W. (Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering). Jun 1975. 179p. Dep. NTIS $12.00.

For Oak Ridge National Lab., TN.

A continuing series of investigations has been conducted to determine experimentally the stress patterns for the junction region of spherical shells with radially and non-radially attached nozzles when subjected to internal pressure and various types of loadings on the nozzles. Results of the investigations conducted on a nonradially attached nozzle of 2.625 in.-OD, 2.500 in.-ID and finished flush with the inner surface of the hemisphere are reported. The nozzle is inclined at 22½° from a radial axis. Stress values were determined for the loading of a pure bending moment or axial couple applied in various axial planes of the nozzle. (LCL)

22192 (ORNL-SUB-2203-3) EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. Part 5c. Nonradial Nozzle at 22-1/2 degrees 2.625 in. O. D.-2.5000 in. I. D., Zero Penetration. Maxwell, R. L.; Holland, R. W. (Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering). Jun 1975. 195p. Dep. NTIS $12.75.

For Oak Ridge National Lab., TN.

A continuing series of investigations has been conducted to determine experimentally the stress patterns for the junction region of spherical shells with radially and non-radially attached nozzles when subjected to internal pressure and various types of loadings on the nozzles. Results of the investigations conducted on a nonradially attached nozzle of 2.625 in.-OD, 2.500 in. ID, and finished flush with the inner surface of the hemisphere are reported. The nozzle was inclined at $22\frac{1}{2}^0$ from a radial axis. Stress values for the following types of loadings are tabulated: internal pressure applied to the hemisphere and nozzle assembly; an axial load applied collinear with nozzle; a pure torque applied in the radial plane of the nozzle; and a pure bending moment or axial couple applied in various axial planes of the nozzle. Various stress vs. profile curves are presented. These curves present the tabulated stress data in graphical format. (LCL)

22193 (ORNL-TM-4710) ANALYTICAL STUDY OF ELASTICAL CREEP-FATIGUE DESIGN RULES FOR ASME HIGH-TEMPERATURE CODE CASE. Corum, J. M.; Sartory, W. K. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 44p. AT.

Twenty-five problems involving elastic-plastic and creep behavior were analyzed both elastically and inelastically, and the results were used to evaluate various elastic creep-fatigue design rules, including those in the ASME Boiler and Pressure Vessel Code Cases for nuclear components in elevated-temperature service. The problems consisted of thin- and thick-walled cylinders, both infinitely long and built-in at one end, and a long notched cylinder, subjected to a variety of carefully chosen temperature and pressure histories. Since elastic rules are provided in the elevated-temperature Code Cases as an alternate to the more rigorous inelastic analysis rules, the philosophy is that the elastic damage predictions should be at least as conservative as the inelastic predictions. The analytical results identified a number of situations in which the current Code Case rules provide damage predictions that are less conservative than the inelastic rules. Recommendations for correcting these apparent deficiencies in the elastic rules are provided. It should be emphasized that no conclusions can be drawn from the present study about the absolute conservatism or nonconservatism of any of the creep-fatigue rules. All conclusions pertain only to the relative conservatism of the elastic rules as compared to the inelastic rules. The margin of conservatism in the inelastic rules may be sufficient that the elastic rules are conservative even when they are less conservative than the inelastic rules. However, since the actual margin of conservatism of the inelastic rules cannot be clearly identified, prudence dictates that the elastic rules be made more conservative. (auth)

22194 (RD/B/N-3244) USER'S GUIDE TO BEREL: A STRESS ANALYSIS PROGRAM FOR PIPE BENDS. Beveridge, D. C. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 35p. Dep. NTIS (US Sales Only) $4.75.

BEREL is a computer program (based on an ORNL program, ELBOW) which calculates circumferential and longitudinal stresses and deflections for in-plane and out-of-plane bending, total stresses and strains, and equivalent stresses for the inside and outside of a pressurized pipe bend under in-plane and out-of-plane moments at specified points around its circumference. Results are tabulated and plotted in graphical form on the line printer. (auth)

22195 (RD/B/N-3324) EXTENSION OF THE BNL GAMMA FACILITY DATA PROCESSOR. Part 2. To March 1975. Stephen, W. J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

A further guide to modifications and extensions to the data processing system developed for the BNL Gamma Irradiation Facility is presented. Extensions have been aimed at increasing the data handling capability by adding magnetic tape and decreasing the time required for program development by adding a faster terminal and improved operating system. Modifications, notably rationalization of power supplied and shortening of interface cabling, are intended to improve system reliability. (auth)

22196 (SAND-75-0159) EFFECT OF SYSTEM PARAMETERS ON SUBSTRATE BIAS DURING D. C. AND R. F. SPUTTER DEPOSITION. Kominiak, G. J.; Bland, R. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1975. Contract AT(29-1)-789. 17p. Dep. NTIS $4.00.

When an electrically isolated substrate holder is immersed in a gas discharge, as in sputter deposition, the holder and substrates are exposed to bombardment by energetic secondary electrons which may result in large substrate bias voltages. The induced substrate potential is affected by many system parameters. In this investigation, we have measured the variation of bias at an electrically floating substrate as a function of gas pressure and target to substrate separation for both d.c. and r.f. sputtering discharges. In the case of d.c. sputtering the voltages in question may attain negative potentials of up to 1 kV. Operating under these conditions will cause severe heating of the substrates and the growing deposits. R.F. sputtering discharges on the other hand, induce relatively small negative (less than -100 V) and positive voltages at the substrate. These small positive biases have been shown to markedly affect the properties of r.f. sputtered metal films. In the case of r.f. sputter deposited chromium, electrically floating the substrates resulted in deposits which were only approximately 70 percent dense. (7 figs, 19 refs) (auth)

22197 N-FUEL COMPLEX GETS BARC-MADE ELECTRON BEAM UNIT. Anon. Nucl. India.; 12: No. 11, 1,3(Jul 1974).

A detailed description of the high power electron beam melting unit recently commissioned at the Nuclear Fuel Complex at Hyderabad, India, is given. In this unit a high energy focussed electron beam is impinged onto the item to be melted. Since melting takes place in a high vacuum of 10 torr, the melted metal is of a very high quality. One of the most difficult metals, tantalum, is melted in this furnace (3000°C). The special features of this unit include: (a) a modified crucible designed for uniform distribution of heat flux from four electron guns, (b) a separate evacuation system for the electron beam gun to permit processing of any heavily gas-loaded sample, and extend filament life, (c) a fast protection system for rectifiers against short circuit currents and over-voltages with the use of triggered spark gaps, (d) a surge suppression device to help fast start-up and (e) a high speed high capacity vacuum system to cut down the pumping time and ensure high vacuum during melting. Although the capital cost of this unit is higher than that of an arc or induction melting unit of a similar capacity, it is indispensable where the quality of melted metal is the main consideration. The use of a high power electron beam unit for melting would be a big advantage to industries involved in the production of refractive and reactive materials like tantalum, niobium and zirconium. (INIS)

22198 ION-IMPLANTED n^+ CONTACTS FOR K_a BAND GaAs GUNN-EFFECT DIODES. Lee, D. H.; Berenz, J. J.; Bernick, R. L. (Hughes Research Labs., Malibu, CA). Electron. Lett.; 11: No. 9, 189-191(1 May 1975).

Shallow (<1 μm) n-type doping profiles with peak carrier concentrations of $\approx 8 \times 10^{17}$ cm^{-3} have been formed by sulfur-ion implantation into vapor-phase GaAs epitaxial layers for improved Gunn-effect-diode contacts. Continuous-wave output powers in excess of 250 mW were measured at 35 GHz, with the implanted n^+ profile biased either as an electron cathode or anode contact. (auth)

Lasers

Refer also to abstract 22925.

22199 (ERDA-tr-54) POSSIBILITY OF CREATING A CO_2 LASER WITH ELECTRON BEAM PUMPING. Dolgov-Savel'ev, G. G.; Kuznetsov, V. V.; Koz'minykh, Yu. L.; Orishich, A. M. Translated from Zh. Prikl. Spektrosk.; 12: No. 4, 737-739(1970). 6p. Dep. NTIS $4.25.

Results of an investigation made on a CO_2 pulse laser with cross sectional introduction of an electron beam with and energy of 0.5 MeV into the discharge gap are given. (TFD)

22200 (SAND-75-5273) ELECTRON-BEAM-EXCITED GAS LASER RESEARCH. Johnson, A. W.; Gerardo, J. B.; Patterson, E. L.; Gerber, R. A.; Rice, J. K.; Bingham, F. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 23p. (CONF-750660-1). Dep. NTIS $4.25.

From second all-union symposium on gas laser physics; Novosibirsk, USSR (Jun 1975).

Net energy gain in laser fusion places requirements on the laser that are not realized by any existing laser. Utilization of relativistic electron beams (REB's), a relatively new source for the excitation of gas laser media, may lead to new lasers that could satisfy these requirements. Already REB's have been utilized to excite gas laser media and produce gas lasers that have not been produced as successfully any other way. Electron-beam-excitation has produced electronic-transition dimer lasers that have not yet

been produced by any other excitation scheme (for example, Xe_2/sup *(1)/, Kr:O(2^1S)^2, KrF/sup *(3)/). In addition, REB's have initiated chemical reactions to produce HF laser radiation with unique and promising results. Relativistic-electron-beam gas-laser research is continuing to lead to new lasers with unique properties. Results of work carried out at Sandia Laboratories in this pioneering effort of electron-beam-excited-gas lasers are reviewed. (TFD)

22201 (SAND-75-5668) STUDIES OF RARE-GAS-HALOGEN MOLECULAR LASERS EXCITED BY AN ELECTRON BEAM. Tisone, G. C.; Hays, A. K.; Hoffman, J. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 6p. (CONF-750914-3). Dep. NTIS $4.00.

From 2nd summer colloquium on electronic transition lasers; Woods Hole, Massachusetts, USA (17 Sep 1975).

Emission from rare-gas-halogen molecules has recently been reported with the suggestion that these molecules are possible candidates for laser systems operating in the near ultraviolet. Laser action has been reported for XeBr, XeCl, and XeF. The results of some preliminary studies of these molecules in electron-beam-excited laser systems are reported. In addition, laser action in the KrF molecule has been observed. In the rare-gas-halogen laser systems investigated, the highest efficiencies and largest output energies were obtained from the KrF and XeF lasers. (TFD)

22202 (SAND-75-5701) MOLECULAR IODINE LASER NEAR 3400 A. Hays, A. K.; Hoffman, J. M.; Tisone, G. C. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 2p. (CONF-750914-2). Dep. NTIS $4.00.

From 2nd summer colloquium on electronic transition lasers; Woods Hole, Massachusetts, USA (17 Sep 1975).

The 3460 to 3015 A band system of I_2 has recently come under investigation as a possible candidate for an electron-beam-initiated laser. The observation of laser oscillations on four separate vibrational bands in this band system is reported. Emission from the 3460 to 3015 A band system of I_2 was observed when mixtures of Ar and various molecules containing iodine (I_2, HI, CH_3I, and CF_3I) were irradiated with a high-energy electron beam. Attempts to produce an I_2 laser near 3400 A using Ar/I_2 mixtures were unsuccessful. Ar/HI mixtures were studied spectroscopically but were never placed in a laser cavity. Laser oscillations were observed in Ar/CH_3I and Ar/CF_3I mixtures. (TFD)

22203 (UCID-16861) STRESS IN HIGH ENERGY FLASHLAMP ENVELOPES. Tuft, D. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Mar 1974. Contract W-7405-Eng-48. 22p. Dep. NTIS $4.25.

Failure of high energy flashtubes which are used to optically pump solid state lasers has become a critical factor in the operation of large laser systems which require large numbers of flashlamps for operation. Failures in flashlamps are generally catastrophic in nature and can cause damage to other critical laser components within the laser head as well as render the laser module inoperable. Attempts have been made to increase the reliability and lifetime of flashlamps by reducing the operating energy at the expense of overall laser efficiency. The extent thermal stress contributes to failure in flashlamps is discussed. Since experimental measurements of temperature or stress fields in a flashlamp envelope during the period of interest (the flashlamp pulse) are not practical, or at best would be extremely difficult, the approach will be from a purely analytical standpoint. Also as a result of the extremely complex nature of the physical mechanisms involved, this note will be an attempt only to bracket the possible stress and temperature fields which occur in a highly idealized model. (auth)

22204 (UCRL-51854) STUDIES OF CALORIMETER ABSORBERS FOR CW AND PULSED CO_2 LASERS. Gunn, S. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jul 1975. Contract W-7405-Eng-48. 15p. Dep. NTIS $4.00.

Solid and liquid absorbers, used in calorimeters to measure the power and energy of cw and pulsed CO_2 lasers, have been studied from 9.24 to 10.76 mu m (cw) and near 10.588 mu m (pulsed). The principal materials used were magnesium oxide, lithium fluoride, polystyrene, polytetrafluorethylene, carbon tetrachloride and kerosene. (auth)

22205 (UCRL-77033) PROSPECTS FOR TRIVALENT RARE-EARTH VAPOR LASERS. Krupke, W. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Jul 1975. 14p. (CONF-750914-1). Dep. NTIS $4.00.

From 2nd summer colloquium on electronic transition lasers; Woods Hole, Massachusetts, USA (17 Sep 1975).

The exceptionally high volatility of the rare-earth-transition-metal trihalides lend themselves for storing substantial amounts of electronic energy. This is illustrated for NdI_3 and Nd-Al-Cl_3 vapors for which half of the molecules have been optically pumped. The dynamic nature of these vapor systems are discussed including rotational, vibrational, and electronic degrees of freedom. Implications of the shielded nature of the 4f/sup n/ electrons of the ground electronic configuration (optically active-chemically inactive) are surveyed. Allowed 4f yields 5d transitions as pump bands and ligand electronic structure are also discussed. (TFD)

22206 PULSED CHEMICAL LASER. Jacobson, T. V.; Kimbell, G. H. US Patent 3,893,045. 1 Jul 1975. Filed date 1 Dec 1974. 10p.

A hydrogen fluoride laser capable of operating super radiantly and at atmospheric pressure is described. A transverse electrical discharge is utilized to energize the reaction of a hydrogen donor to provide hydrogen fluoride in a metastable energy state which reverts to a stable state by laser action. A large range of hydrogen and fluorine donors is disclosed. A preferred pair of donors is sulphur hexafluoride and propane. Helium is frequently added to the gas mix to act as a buffer. (auth)

22207 X-RAY LASERS. Chapline, G.; Wood, L. (Univ. of California, Livermore). Phys. Today; 28: No. 6, 40-45; 48(Jun 1975).

Possible approaches to the development of x-ray lasers are reviewed. The impact of x-ray lasers on research in chemistry, biology, and crystallography are discussed. (TFD)

22208 ELECTRON BEAM EXCITATION OF VACUUM ULTRAVIOLET LASERS. Wallace, S. C.; Kenney-Wallace, G. A. (IBM Watson Research Center, Yorktown Heights, NY). Int. J. Appl. Radiat. Isot.; 7: No. 2/3, 345-362(Apr 1975).

Since the hydrogen laser near 160 nm was reported in 1970, there has been dramatic progress in the development of sources of coherent light in the vacuum ultra-violet (vuv). This review discusses recent experimental work and relevant basic physical principles of vuv lasers. It is a consequence of the requirement for high-power excitation that high-current relativistic electron beams have been utilized most successfully for pumping vuv lasers. Thus there is a significant interest in elucidating the kinetic details of the formation and decay of the excited species from which laser action has been observed. The hydrogen, carbon monoxide and noble gas molecular dissociation lasers are described in terms of the experimental configurations employed and their kinetic spectroscopy. The maximum power levels reported are $\geq 10^2$kW cm^{-2} in Lyman band of hydrogen, 4.8 kW cm^{-2} in the Werner band of deuterium, at 90 K, 15 W cm^{-2} in carbon monoxide and 60 MW cm^{-2} in xenon. Details of the recently developed high-power, tunable xenon laser are also presented. An account of coherent radiation in the vuv obtained through harmonic generation is included as an integral part of the future potential of vuv spectroscopy. It is hoped that this review will stimulate further investigation of the photophysical properties of present and future laser systems excited by ionizing radiation. (auth)

22209 FREQUENCY CHARACTERISTICS OF A HELIUM–NEON RING LASER. Markelov, V. A. (Radiofizicheskii Institut, Gorki, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 11, 1642-1648(1974). (In Russian).

The frequency characteristics of a circular helium–neon laser operating in single-mode regime at 0.63-micron wavelength are investigated. The effect of the resonator and active region parameters for arbitrary ratio of neon isotopes is studied. (IAA)

22210 VARIABLE TEMPERATURE CHAMBER (INSERT DEWAR) FOR SUPERCONDUCTING MAGNETS WITH A BUILT-IN HELIUM TRANSFER LINE. Oliveira, N. F. (Univ., Sao Paulo, Brazil). Cryogenics; 15: No. 5, 293-294(May 1975).

The design and construction of stainless steel insert dewars, specially adapted for superconducting magnets to provide them with a variable temperature experimental space, are reported. (UK)

22211 EXPERIMENTAL INVESTIGATIONS OF A STABLE CO_2–TEA LASER WITH A DOUBLE-DISCHARGE-SYSTEM. Donnerhacke, K. H.; Rentsch, M.; Rose, J. (Zentralinstitut fuer Elektronenphysik, Jena, Ger.). Exp. Tech. Phys.; 22: No. 6, 549-556(1974). (In German).

A report is given on a compact and reliable CO_2 TEA-laser with a double discharge system. The laser parameters being of importance for application, such as pulse energy and its reproducibility, pulse length, spectral composition, mode behavior and divergence are investigated. For a mean pump energy density of $W_E/V \approx 80$ mWs/cm^3 the output energy density is $W_A/V \approx 16$ mWs/cm^3 [TEM_{00}, P(20), CO_2: N_2: He = 1 : 1 : 2, $\rho\Sigma$ = 600 torr]. The reproducibility of the pulse energy is $\sigma \pm 3\%$, the efficiency $\eta = 18\%$. For the maximum possible pump energy density of $W_A/V = 180$ mWs/cm^3 the output energy density is $W_A/V = 27$ mWs/cm^3 and the efficiency $\eta = 14\%$. (auth)

22212 KINETICS OF LASER GENERATION WITH EXTERNAL HIGH-FREQUENCY MODULATION OF LOSS COEFFICIENT. Loiko, N. A.; Samson, A. M. Zh. Prikl. Spektrosk.; 22: No. 4, 623-632(Apr 1975). (In Russian).

An analysis is presented of an external high-frequency modulation of the coefficient of loss of a linear laser based on nonlinear differential equations with deflecting argument for radiation density and coefficient of reinforcement of the active medium. The natural vibrations of the system (vibrations at constant coefficient of loss) checked the resonance action when the frequency coincided with Fourier frequencies of the modulated signal. Parameters at which stable natural vibrations, quite different from resonance, may be compared with modulation vibrations were evaluated. The dependence of deep modulations on the difference in frequency of modulation of the relatively natural frequency of the system and on the location of the modulator in the resonator was determined. The results of the analytical study were compared with computer calculations. (tr-auth)

22213 ULTRA-SHORT PULSED LASER IN DYES WITH SMOOTH REARRANGEMENT OF RADIATION SPECTRUM. Koes, I. M.; Pubinov, A. N. Zh. Prikl. Spektrosk.; 22: No. 4, 761-762 (Apr 1975). (In Russian).

An ultra-short-pulsed laser was generated in dyes with smooth rearrangement of the radiation spectrum. The reorganization is explained by a diffraction lattice which is used as one of the mirrors of the resonator of the laser in the dye. The laser was pumped in the dye by a train of ultra-short pulses of the second harmonic of a ruby laser. Spectra of generation of the laser in the dyes are presented. (tr-auth)

22214 METER FOR DETERMINING THE ENERGY OF TEN-MICRON PULSES OF RADIATION WITH INTENSITIES FAR IN EXCESS OF MEGAWATTS. Karlova, E. K.; Kuz'min, G. P. (Physical Inst., Moscow). Instrum. Exp. Tech.; 17: No. 5, 1443-1444(1974).

Translated from Prib. Tekh. Eksp.; No. 5, 165-166(1974).

In order to measure the energy of the pulses from a CO_2 laser with a power approaching 10^8 W, it is proposed to use an instrument consisting of a strongly-absorbing, rupture-resistant working substance in combination with a copper resistance thermometer. (auth)

22215 USE OF PHOTOELECTRON MULTIPLIER WITH A DYNAMIC CONVERTER IN THE FREQUENCY-STABILIZATION SYSTEM OF A LASER. Kapralov, V. P. (All-Union Scientific-Research Inst. of Metrology, Leningrad). Instrum. Exp. Tech.; 17: No. 5, 1439-1442(1974).

Translated from Prib. Tekh. Eksp.; No. 5, 162-165(1974).

The possibility of stabilizing the frequency of an LG-56 industrial gas laser with the aid of a photoelectron multiplier containing a dynamic converter and a system for automatically adjusting the length of the resonator is examined experimentally. Frequency stabilization is effected by comparing the beat frequency of the longitudinal modes ($\Delta\nu$ = 510 MHz) with the signal from a G4-31 generator. A frequency stability of 2×10^{10} in 1 min is achieved. (auth)

22216 LASER HETERODYNE AND TRANSMITTER AUTOMATIC FREQUENCY CONTROL SYSTEM. Borzunov, N. G.; Popov, L. N.; Poizner, B. N. (Tomsk State Univ., USSR). Instrum. Exp. Tech.; 17: No. 5, 1437-1438(1974).

Translated from Prib. Tekh. Eksp.; No. 5, 161-162(1974).

To investigate modulated low-frequency radiation from a laser, a system is described with a common resonator for the discharge tube, the heterodyne, and the transmitter, which increases the stability of the difference frequency by a factor of 15. (auth)

22217 FREQUENCY STABILIZATION OF A 3.39-μ He + Ne LASER. Konovalov, I. P.; Protsenko, E. D. (Moscow Engineering-Physics Inst.). Instrum. Exp. Tech.; 17: No. 5, 1433-1436 (1974).

Translated from Prib. Tekh. Eksp.; No. 5, 158-160(1974).

The frequency stabilization of an LG-126 3.39-μ laser is described. The mean-square frequency deviation over 10 min amounted to 10^{-10}. A theoretical analysis of the method is carried out. A magneto-optical quarter-wave modulator is described by means of which the linearly polarized radiation of the laser is converted into radiation with a periodic time-varying direction of the circular polarization. (auth)

22218 GENERATION OF A NUMBER OF ORGANIC EUROPIUM COMPLEXES IN SOLUTION DURING LASER EXCITATION. Malashkevich, G. E.; Kuznetsova, V. V. Zh. Prikl. Spektrosk.; 22: No. 2, 230-233(Feb 1975). (In Russian).

Metallorganic compounds (MOC) have a good outlook for use as laser materials. The purpose of this study was to investigate the emission kinetics of rare earth chelate solution during single-pulse laser excitation and to determine the possibilities of using these chelates as light converters. The readily soluble chelates $Eu(TTA)_4 \cdot HP$ and $Eu(BA)_4 \cdot HP$ were used in the studies. Here TTA is a thenoyltrifluoroacetone molecule; BA is a benzoyl acetone molecule, and P is a piperidine molecule. Luminescence and generation spectra are presented. A laser effect was also obtained on an alcoholic solution of $Eu(TTA)_4 \cdot HP$. (SJR)

22219 LASER DEVICE HAVING ENCLOSED LASER CAVITY. Dumke, W. P.; Woodall, J. M. (to International Business Machines Corp.). US Patent 3,893,044. 1 Jul 1975. Filed date 12 Apr 1973. 10p.

A semiconductor laser device having an enclosed laser cavity is disclosed. The semiconductor laser is of the heterostructure type and embodiments of single and double heterostructures are disclosed. In both of the heterostructure devices, the side surfaces of the active region are well defined. This is accomplished, in one instance, by surrounding the laser active region on all side surfaces with a higher band gap material which also has a lower index of refraction. Thus, the laser cavity is partially enclosed by a semiconductor material on one conductivity type of a band gap higher than the band gap of the material of the laser cavity. The remaining portion is enclosed by a band gap material higher than the material of the laser cavity but is of opposite conductivity type to the first mentioned higher band gap material. In another instance the side surfaces of the laser active region are partially surrounded by a high band gap material and partially by a region of opposite conductivity type to the active region; both of which regions contribute carriers to the active region. The laser devices are made, for example, from layers of appropriately doped P and N type gallium arsenide and from layers of P and N type gallium aluminum arsenide. The resulting devices can have very small cavity cross sections, optical and electrical confinement of the excitation at all the side surfaces, low electrical series resistance and a low thermal resistance due to geometrical factors. The laser devices may be fabricated using well known fabrication techniques which include deposition of the layers of the laser by liquid phase epitaxy (LPE), molecular beam epitaxy (MBE) and melt-back or etching techniques. The latter techniques define the laser cavity. (auth)

22220 TUNABLE INFRARED LASERS. Nill, K. W. (MIT, Lexington, MA). Opt. Eng.; 13: 516-522(1974).

From seminar on impact of lasers in spectroscopy; San Diego, CA (19 Aug 1974).

Tunable infrared lasers have been used in research laboratories for ultrahigh resolution spectroscopy measurements of molecular gases. While these lasers offer the potential for greatly improving instrument (e.g., laser spectrometer) performance, implementation of the instrument function is complicated by the nature of the laser source. Laser characteristics which must be considered include factors such as tuning mechanisms, spectral purity, stability and power. These characteristics are reviewed for a variety of tunable infrared lasers including diode lasers (TDL), optical parametric oscillators (OPO), and high pressure gas lasers (HPG). Particular attention is paid to recent developments in the TDL, including continuous operation at 8.5 microns wavelength at temperatures above liquid nitrogen and high power efficiency in the 4 to 5 micron region with output powers of about 0.3 W. Spectroscopic techniques used for obtaining high resolution spectra in the 3.5 to 20 micron region are discussed and illustrated with spectra of NO, CO_2, and H_2O. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 22151, 22174, 22175, 22983, 22996, 23000, 23001, 23008, 23010, and 23028.

22221 (AD-786240) THEORY AND DESIGN OF ELECTRICAL ROTATING MACHINERY. Annual Technical Report No. 2, 1 May 1973–30 April 1974. Carr, W. J. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Research and Development Center). Sep 1974. 16p. NTIS $3.25.

The objective of the program is to contribute toward new and improved rotating machines for naval applications, with emphasis on superconducting machinery. An important factor in the design of superconducting machinery is the ac hysteresis and eddy current loss which occurs in the multifilament conductors generally used for ac operation. Reduction of this loss, to reduce the required refrigeration capacity, is necessary for wide-range use of superconducting machines. Theory has been developed and substantial progress has been made toward understanding the ac loss in multifilament conductors. The theory may be used for the design of optimum conductors. In the area of actual machine research, a low speed, high torque heteropolar dc superconducting motor has been studied with encouraging re-

sults. In addition the maximum power rating of various types of dc machines has been estimated. (auth)

22222 (CEA-CONF-3064) BEHAVIOUR OF SMALL COILS: CURRENT SHARING AND LOSSES WITH RESISTIVE BARRIERS. Genevey, P.; Nithart, H.; Noel, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. du Synchrotron Saturne). 21 Apr 1975. 5p. (CONF-750438-4). Dep. NTIS (US Sales Only) $4.00.

From 5th international conference on magnet technology; Frascati, Italy (21 Apr 1975).

Owing to a resistive barrier between composites in a superconducting conductor it is possible to share current when composites are broken without important extra losses in pulsed conditions. With a copper oxide obtained by heating in dry air no degradation in dc or ac conditions appears with about 30% of faulty composites. (auth)

22223 (COO-2552-2) ASSESSMENT AND STUDY OF EXISTING CONCEPTS AND METHODS OF CRYOGENIC REFRIGERATION FOR SUPERCONDUCTING TRANSMISSION CABLES. Progress report, 1 May 1975-30 June 1975. Kadi, F. J.; Longsworth, R. C. (Air Products and Chemicals, Inc., Allentown, Pa. (USA). Advanced Products Dept.). 1975. Contract E(11-1)-2552. 33p. Dep. NTIS $4.75.

Research progress is reported on the following topics: completion of work from the previous report period; criteria used to fix He operating temperatures and pressures; establishment of the distance between refrigerator stations; rusts to refrigerator users; contact of refrigeration and component manufacturers; and work plan for next report period. (TFD)

22224 (JINR-P8-8850) MULTIPURPOSE HELIUM REFRIGERATOR. Agapov, N. N.; Belushkin, V. A.; Zel'dovich, A. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A helium refrigerator for cooling a large superconducting system is described. The refrigerator has a helium expansion engine and uses liquid nitrogen for precooling. It can work both in the liquefaction and in the refrigeration mode. The refrigerator can produce liquid helium at the boiling temperature as well as supercooled one. There exists the possibility of controlling the expansion engine flow to get optimum results at special mode, i.e., cooling of magnet with production of liquid helium at the same time. The capacity of the refrigerator is 240 W. Some of characteristics of the refrigerator are shown. (auth)

22225 (LA-5953-MS) DESIGN OF A FORCE-FREE INDUCTIVE STORAGE COIL. Mawardi, O. K. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1975. Contract W-7405-ENG-36. 11p. Dep. NTIS $4.00.

Force-free coils have been considered for various applications as energy storage devices. A novel energy storage system consisting of both toroidal and poloidal coils has been developed. In this system, the Lorentz forces on the two coils are in opposition and can be made to cancel by having the proper ratio of ampere-turns in the two coils. A general discussion of force-free coil design is given, and the toroidal-poloidal coil system is described. The materials costs of magnets constructed with this and other geometries are compared. The conclusions are that conductor cost of this system lies between those of solenoids and toroids, and that the costs of structural material may be considerably less than either of these simpler coils. (auth)

22226 (LA-UR-75-189) STABILIZING SUPERCONDUCTORS FOR POWER ENGINEERING APPLICATIONS. Hoffer, J. K.; Kerr, E. C.; Laquer, H. L. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. 7p. (CONF-750715-1). Dep. NTIS $4.00.

From power meeting of the IEEE; San Francisco, California, USA (20 Jul 1975).

Exhibiting essentially zero resistivity at high current densities and large magnetic fields, modern superconducting materials offer intriguing possibilities in power engineering. However, in order to utilize this property in any large scale application, the superconductor must be stable during fault and overload transients in the total system. In order to know whether the superconductor itself is stable, one must understand and control the detailed mechanisms of magnetic flux motion which occur in the material. Such flux motion will give rise to a non-zero resistivity and hence will always involve heat generation, which in turn will perturb the low temperature environment necessary to sustain superconductivity. This paper discusses the essential differences between superconductors and ordinary conductors; the control of heat generation resulting from magnetic flux motion necessary to insure that the superconductor is stable; and some experiments on models of dc superconducting transmission cables which test the theoretical assumptions. (auth)

22227 (LBL-3593) LOW FREQUENCY NOISE IN JOSEPHSON JUNCTIONS. Clarke, J.; Hawkins, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1975. Contract W-7405-ENG-48. 5p. (CONF-750937-1). Dep. NTIS $4.00.

From 4th international conference on physical aspects of noise in solid state devices; Noordwijerhout, Netherlands (9 Sep 1975).

The low-frequency power spectrum of voltage fluctuations in shunted Josephson tunnel junctions biased with a constant current I greater than the junction critical current I/sub c/ was measured. It was found that the frequency dependence of the power spectrum is very nearly 1/f and that the amplitude of the spectrum is quantitatively predicted by a suitable modification of the semi-empirical formula of Clark and Voss in Phys. Rev. Lett.; 33: 24(1974). (TFD)

22228 (UCRL-50016-75-2) MECHANICAL ENGINEERING DEPARTMENT. Quarterly Report: April-June 1975. Stone, R. G.; Barnett, J. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Jun 1975. Contract W-7405-Eng-48. 32p. Dep. NTIS $4.75.

A separate abstract was prepared for each of the four sections of the report. (MOW)

For abstracts of individual sections see: 22175, 22176, 22256, and 23023.

22229 SUPERCONDUCTIVE ENERGY STORAGE INDUCTORS: INTERNAL TRANSIENT OSCILLATIONS AND EDDY CURRENT LOSSES. Hartmann, D. P. Madison, WI; Univ. of Wisconsin (1974). 117p. University Microfilms Order No. 74-28,804. Thesis (Ph. D.).

The effects of fault induced transient oscillations are investigated using both analytic equations and a digital computer solution to state-space analysis of pi-section equivalent circuits. It was found that, because of the damping of the external resistance in the inverter-converter portion of the superconductive energy storage inductor system, the possibility of transient induced long term oscillations is precluded. An eigenvalue solution for the relaxation modes of a filamentary model for square and rectangular cross section, very long, isolated conductors was achieved using the EISPACK computer routine. Through the use of Fourier-series analysis, it was possible to obtain MODAL solutions for the effective resistance ratios and for relative current density distributions. These were done for a constant cross sectional area rectangular conductor with side ratios of 1 : 1, 2 : 1, 4 : 1, and 10 : 1. In addition, a filamentary model for a superconductive filament near the center corner of each quadrant of the conductor was used to determine effective resistance ratios for various frequencies of applied current. It was confirmed that for the low frequencies or relatively deep penetration depths, that the skin depth approximation for effective resistance is not valid. (Diss. Abstr. Int., B)

22230 SQUID OPERATION WITH FERROMAGNETIC CORE SUPERCONDUCTING DC TRANSFORMERS. Cerdonio, M. (Univ., Rome); Romani, G. L.; Pace, S. Cryogenics; 15: No. 5, 278-282 (May 1975).

Ferromagnetic core (Cryoperm 10) superconducting transformers have been successfully used to enhance the transfer of external magnetic flux to a symmetric two-hole rf biased quantum interference device (SQUID). The flux transfer ratio has been enhanced up to a factor of ten in comparison with air core superconducting transformers. It has been observed that the presence of ferromagnetic cores in the holes of the SQUID does not introduce additional noise, while it introduces a reduction in the Q of the 19 MHz tank circuit. The experimental results are discussed in the framework of a detailed analysis of the behavior of the complete SQUID plus tank circuit and ferromagnetic core superconducting transformer circuit. (auth)

22231 POSSIBLE ENERGY SAVING BY COMPENSATING HEAT INPUTS TO LIQUID HELIUM THROUGH CURRENT LEADS AND THERMAL BRIDGES. Keilin, V. E. (Inst. of Atomic Energy, Moscow). Cryogenics; 15: No. 4, 208-209(Apr 1975).

The possibility of energy saving by compensating heat inputs to liquid helium through current leads and thermal bridges is discussed. This saving is due to a suitable distribution of evaporated helium between current leads (or thermal bridges) and a refrigerator. In the analytical model considered energy savings for current leads compared to the theoretical minimum are of order 10 to 15%, for thermal bridges savings are possible only if the temperature of the hot end is equal to or lower than that of liquid nitrogen. (auth)

22232 DC HETEROPOLAR MACHINE WITH SUPERCONDUCTING FIELD WINDINGS. Beresford, J. E.; Green, M. J. I. (Tasmania Univ., Sandy Bay, Australia). Cryogenics; 15: No. 4, 228(Apr 1975).

A brief description is given of current research into the use of superconductors in heteropolar dc machines. The two main prob-

lems are the cryogenic technology required and the shielding of the superconducting field windings from the armature reaction fluxes. To overcome the latter a simple compensating winding has been designed and tested in a model. Development is now being directed towards removing almost all of the iron from the rotor to save weight and cost and to allow greater specific electric loading of the armature, reduction in the commuting inductance of the armature coils and an accessible winding for cooling purposes. A diagramatic section through the machine under construction is given. (UK)

22233 SUPERCONDUCTING ROTOR. Laskaris, E. T. (to General Electric Co.). US Patent 3,891,875. 24 Jun 1975. Filed date 16 Oct 1973. 14p.

A dynamoelectric machine rotor has a superconducting field winding and a normally conducting amortisseur winding secured to a closed mounting cylinder and is secured interiorly of and coaxially with a support cylinder in fixed relation thereto. A drive shaft is disposed interiorly of one end of the support cylinder and is secured thereto by a first insulating ring. A carrier cylinder is disposed interiorly of the other end of the support cylinder and is mounted thereto by a second insulating ring. The amortisseur winding is secured at one end to the drive shaft and at the other end to the carrier cylinder. An annular space is defined between the field winding and the amortisseur winding with an annular vacuum envelope and radiation shields disposed therein. Cryogenic fluid flows through the field winding and centers axial channels defined by the field winding and support cylinder, from which it flows to annular ducts at both ends of the field winding. (auth)

22234 SUPERCONDUCTING POINT CONTACT ADJUSTABLE IN HELIUM. Antyukh, E. V.; Nad, F. Ya. (Inst. of Radio Engineering and Electronics, Moscow). Instrum. Exp. Tech.; 17: No. 5, 1528-1539(1974).

Translated from Prib. Tekh. Eksp.; No. 5, 228-229(1974).

The design of the point contact working in He is described; the basic component is a supporting holder with wire electrodes, which is adjusted with a differential screw from outside the cryostat. Details are given of the manufacture, preparation, and assembly of the device together with the parameters and the stability. (auth)

22235 APPLICATION OF SUPERCONDUCTING SHIELDS TO INCREASE THE UNIFORMITY OF SOLENOID MAGNETIC FIELDS. Bychkov, Yu. F.; Tarutin, O. B.; Uzlov, V. Yu. (Moscow Inst. for Engineering and Physics). Instrum. Exp. Tech.; 17: No. 5, 1463-1465(1974).

Translated from Prib. Tekh. Eksp.; No. 5, 179-181(1974).

The effect of superconducting shield construction and maximum shielding current, and the external field strength on increasing of field uniformity inside the solenoid is studied. Laminated tubular shields, wound from a single Nb_3Sn-coated ribbon, significantly increased the field uniformity almost in the entire solenoid volume at fields of up to 60 kOe. (auth)

22236 JOSEPHSON DEVICE OSCILLATOR CIRCUIT. Terlep, K. D. IBM Tech. Disclosure Bull.; 17: No. 5, 1441-1444(Oct 1974).

A Josephson device oscillator circuit and timing diagram utilizing coupled bistable superconducting loops are described. Each loop can have current flowing in the right or left branch depending upon, respectively, whether the device within the right or left branch has been previously switched to its resistive state. A third device is included in each loop for oscillator reset. Loop currents are defined and device control currents are shown adjacent to the devices. (RCK)

22237 APPLICATIONS OF CRYOGENIC TECHNOLOGY. Volume 6. National Symposium and Exhibition, Los Angeles, California, October 2–4, 1973. Booth, S. H.; Vance, R. W. (eds.). Flushing, NY.; Scholium International Inc. (1974). 301p. (CONF-7310103–).

Eight selected papers on liquid natural gas systems, six chapters covering recent technology in the use of liquid and gaseous helium, and three articles on other applications (food freezing, hydrogen motor fuels, and aerospace cryogenics) are included in this continuing effort to provide a complete reference library on cryogenic technology. A separate abstract was prepared for three of the articles. (PMA)

For abstracts of individual papers see: 22996, 23603, and 23604.

Heat Transfer and Fluid Flow

22238 (AECL-5059) OCCURRENCE OF UPSTREAM DRYOUT IN UNIFORMLY HEATED CHANNELS. Groeneveld, D. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1975. 8p. (CONF-740925-10). Dep. NTIS (US Sales Only) $4.00. AECL $0.20.

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

At mass flows greater than 4000 kg/m^2.s and qualities between 8% and 45%, dryout was observed in Freon-12 upstream from the outlet end of a uniformly heated tubular test section. Upstream dryout has also been observed during other high mass flow experiments: in Freon-12 in multi-rod bundles at the above conditions and in steam-water in tubes at Freon equivalent conditions. Upstream dryout is postulated to occur as a consequence of deterioration of the heat transport properties near the wall in the high mass velocity froth flow regime. (auth)

22239 (KFK-2085) FLOW PATTERN, PRESSURE DROP, AND CRITICAL HEAT FLUX OF A TWO-PHASE SODIUM FLOW. Kaiser, A.; Peppler, W.; Voeroess, L. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Apr 1975. 81p. (In German). Dep. NTIS (US Sales Only) $7.25.

For further investigations of sodium boiling, a new test series was carried out in a sodium boiling loop with an induction heated test section. Contrary to previous tests, special attention was paid to achieve quasi steady-state boiling conditions. In an adiabatic measuring section down-stream of the heated zone the two-phase pressure loss and the film thickness were measured up to the critical cooling conditions. The experimental results are compared with values predicted by known models on two-phase flow. The comparison yields that a prediction of the type of flow, especially the distribution of the liquid phase over the flow cross section, produces a satisfactory result only if the two-phase pressure loss gradient is known with sufficient accuracy. As a rule, the flow patterns of pure annular flow and annular mist flow proved to be dominating. Moreover, measurements showed that the boundary value for mass flow, ie., the minimum mass flow to prevent dryout, can be estimated reliably only if the two-phase pressure loss is known. (auth)

22240 (KFK-2099) TURBULENT FLOW IN CONCENTRIC ANNULI. Rehme, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). May 1975. 189p. (In German). Dep. NTIS (US Sales Only) $12.50.

Fully developed turbulent flow through three concentric annuli was investigated experimentally for a Reynolds number range from $Re = 2 \times 10^4$ to 2×10^5. Measurements were made of the pressure drop, the positions of zero shear stress and maximum velocity, and the velocity distribution in annuli of radius ratios $\alpha = 0.02$, 0.04, and 0.1, respectively. The results for the key problem in the flow through annuli, the position of zero shear stress, showed that this position is not coincident with the position of maximum velocity. Furthermore, the investigation showed the strong influence of spacers on the velocity and shear-stress distributions. The numerous theoretical and experimental results in the literature which are based on the coincidence of the positions of zero shear stress and maximum velocity are not in agreement with reality. The structure of turbulence was also investigated experimentally for the same Re range. Measurements were made of the turbulence intensities in the three directions and of the turbulent shear stresses in axial and azimuthal direction. The results showed that the structure of turbulence for these asymmetric flows is different compared with symmetrical flows (tubes and parallel plates). The main difference between symmetrical and asymmetric flows is that for the latter the diffusion of turbulent energy plays an important role. This is the reason not only for the non-coincidence of the positions of zero shear stress and maximum velocity but also for the failure of some turbulence models for calculation of asymmetric flows discussed in the paper. A complete set of the tabulated experimental results is given in the appendix. (auth)

22241 (KFKI-75-31) MODEL FOR TWO-PHASE FRICTIONAL PRESSURE DROP CALCULATIONS. Maroti, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 33p. Dep. NTIS (US Sales Only) $4.75.

A semihomogeneous flow model was used to derive an expression for the two-phase friction factor multiplier. It has been found that the friction factor multiplier based on the homogeneous model must be completed by two additional terms, one considering the momentum difference between the homogeneous and the real two-phase flow and the other composed of the momentum of vapor relative motion. The model proves that each flow pattern must be handled by a different relationship. Expressions for bubbly and dispersed vertical upward flow are presented. The relevant relationship correlates Becker's experimental results well. The deviations between measured and calculated data are less than ±20% in a wide range of parameters. (auth)

22242 (KFK-2131) ROUGHNESS PARAMETER FOR RECTANGULAR ROUGHNESSES AS A FUNCTION OF GEOMETRICAL

SHAPE. Baumann, W.; Rehme, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Apr 1975. 65p. (In German). Dep. NTIS (US Sales Only) $6.25.

A relation for the roughness parameter R of the velocity profile in a fully turbulent flow was established as a function of the geometric parameters of the roughness elements. The evaluation is based on a detailed analysis of experimental results described in the literature. Numerous data on friction factors and velocity profiles in channels with artificial rectangular wall roughnesses were taken into account. The geometrical parameters are the ratio of distance to height, the ratio of height to width of the roughness, and the ratio of the height of the roughness to the length of the velocity profile from the rough wall to the position of zero shear stress. Application of the relation determined in this way, which holds over a very broad range of geometric parameters, allows the pressure drop to be calculated with a rather good accuracy in channels with rectangular wall roughnesses. (auth)

22243 (LA-5942-MS) NUMERICAL CALCULATION OF TWO-PHASE FLOWS. Travis, J. R.; Harlow, F. H.; Amsden, A. A. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-ENG-36. 12p. Dep NTIS $4.00.

The theoretical study of time-varying two-phase flow problems in several space dimensions introduces such a complicated set of coupled nonlinear partial differential equations that numerical solution procedures for high-speed computers are required in almost all but the simplest examples. Efficient attainment of realistic solutions for practical problems requires a finite-difference formulation that is simultaneously implicit in the treatment of mass convection, equations of state, and the momentum coupling between phases. Such a method is described, the equations on which it is based are discussed, and its properties are illustrated by means of examples. In particular, the capability for calculating physical instabilities and other time-varying dynamics, at the same time avoiding numerical instability is emphasized. The computer code is applicable to problems in reactor safety analysis, the dynamics of fluidized dust beds, raindrops or aerosol transport, and a variety of similar circumstances, including the effects of phase transitions and the release of latent heat or chemical energy. (auth)

22244 (LIB/Trans-576) CONTRIBUTION TO THE STUDY OF TWO-PHASE STEAM-WATER CRITICAL FLOW. Reocreux, M. Oct 1974. Translation by A. Bicevskis of Thesis. 19p. Dep. NTIS (US Sales Only) $4.00.

Conservation equations were derived to describe two-phase flow systems and conditions were established in order to satisfy critical flow. The theoretical analysis performed to establish the above condition has demonstrated the important part played by transfer terms. Experimental studies on glass and metal channels showed the importance of the way evaporation was initiated. (AT)

22245 (RD/B/N-3303) CAVITATION INCEPTION WITH WALL GENERATED GAS BUBBLES AS NUCLEI. Baum, M. R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

Where wall generated gas bubbles are the sole source of cavitation nuclei, it is shown that the commonly observed variation in cavitation inception pressure with velocity in a given system can be attributed to variations in the size of the gas bubbles detached from the system wall. However, it is concluded from a comparison of predicted and experimental variations of inception pressure with scale of the system, that when considering scale effects, the pressure necessary to promote gas bubble growth at the boundary must also be taken into account. (auth)

22246 ENGINEERING HEAT TRANSFER. Welty, J. R. New York; John Wiley and Sons, Inc. (1974). 524p. $19.95.

The basic concepts of heat transfer are covered with special emphasis on up-to-date techniques for formulating and solving problems in the field. The discussion progresses logically from phenomenology to problem solving, and treats numerical, integral, and graphical methods as well as traditional analytical ones. The book is unique in its thorough coverage of the fundamentals of numerical analysis appropriate to solving heat transfer problems. This coverage includes several complete and readable examples of numerical solutions, with discussions and interpretations of results. The book also contains an appendix that provides students with physical data for often-encountered materials. An index is included. (auth)

22247 EXPERIMENTAL STUDY OF HEAT TRANSFER THROUGH LIQUID METAL UNDER STRONG CENTRIFUGAL ACCELERATION. Le Grives, E.; Genot, J. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)). Rev. Gen. Therm.; 14: No. 159, 195-204(Mar 1975). (In French).

An experimental study concerning heat transfers by convective cycle (thermosyphon) or evaporative cycle (phase change) of a liquid metal subjected to a high centrifugal acceleration has been carried out with a system incorporating a high speed rotor. The maximal acceleration is $1.2 \times 10^5 ms^{-2}$ at the average radius (0.165m). The heat-carrier fluid circulates radially inside two identical test tubes diametrically opposed, in sealed cylindrical channels drilled from one to the other of each of their ends. The heat source is supplied at the periphery by radiation of the graphite areas; the flow is transmitted by the heat carrier fluid to the other where air-cooled finned heat-exchanges are fitted. The maximum density of the dissipated flows reaches $6.6 \times 10^5 W\ m^{-2}$. (FR)

Materials Testing

Refer also to abstracts 22078, 22415, 22438, and 23673.

22248 (AED-CONF-75-054-001) LOCALIZATION OF ULTRASONIC EMISSIONS IN LARGE STRUCTURAL COMPONENTS. von Klot, R. (Battelle-Institut e.V., Frankfurt am Main (F. R. Germany)). 1975. 4p. (In German). INIS.

From 4th common meeting and colloquium of the Deutsche Arbeitsgemeinschaft fuer Akustik; Braunschweig, F. R. Germany (7 Apr 1975).

Sound emission analysis (SEA) is a new nondestructive method of testing for the detection and localization of faults (e.g., cracks, slag inclusions, or corrosion damage) in large constructional units. When under strain, these faults emit sound pulses (sound emission) of a frequency spectrum that goes far into the ultrasonic region. If a number of probes is attached to a constructional unit under analysis, the signals emitted by one source will reach the probes at different times. The location of the fault can then be calculated from the measurable differences in the delay of transmission. (auth)

22249 (BDX-613-1353) MEASURING PENETRATION DEPTH OF ELECTRON BEAM WELDS. Final Report. Hill, J. W.; Collins, M. C.; Mentesana, C. P.; Watterson, C. E. (Bendix Corp., Kansas City, Mo. (USA)). Jul 1975. Contract AT(29-1)-613. 17p. Dep. NTIS $4.00.

The feasibility of evaluating electron beam welds using state-of-the-art techniques in the fields of holographic interferometry, micro-resistance measurements, and heat transfer was studied. The holographic study was aimed at evaluating weld defects by monitoring variations in weld strength under mechanical stress. The study, along with successful work at another facility, proved the feasibility of this approach for evaluating welds, but it did not assign any limitations to the technique. The micro-resistance study was aimed at evaluating weld defects by measuring the electrical resistance across the weld junction as a function of distance along the circumference. Experimentation showed this method, although sensitive, is limited by the same factors affecting other conventional nondestructive tests. Nevertheless, it was successful at distinguishing between various depths of penetration. It was also shown to be a sensitive thickness gage for thin-walled parts. The infrared study was aimed at evaluating weld defects by monitoring heat transfer through the weld under transient thermal conditions. Experimentation showed that this theoretically sound technique is not workable with the infrared equipment currently available at Bendix Kansas City. (auth)

22250 (CENC-1239) TEST REPORT ON EXPERIMENTAL STRESS ANALYSIS OF A 24 INCH DIAMETER TEE (ORNL T-16). Henley, D. R. (Combustion Engineering, Inc., Chattanooga, Tenn. (USA). Nuclear Components Dept.). Jun 1975. Subcontract 3310. 145p. (ORNL-SUB-3310). Dep. NTIS $10.25.

For Oak Ridge National Lab., TN.

The experimental stress analysis and low cycle fatigue test of one 24" x 24" x 24" schedule 10 stainless steel, ANSI B16.9 tee performed by Combustion Engineering, Inc. are described. The tee was instrumented with 230 rectangular strain gage rosettes. Elastic data was obtained for 12 loading conditions consisting of internal pressure and orthogonal pure moments and orthogonal direct forces applied individually to the free branch and run ends of the tee. One of the run ends of the tee was "built in" throughout the test. All loads were applied through pipe extensions welded to the tee. The tee was fatigue tested to failure by applying a cyclic in-plane moment to the branch of the tee assembly. A through-the-wall fatigue crack occurred at 2344 cycles. Significant tests results are summarized and compared with design values tabulated in the ASME Boiler and Pressure Vessel Code, Section III, 1971. (auth)

22251 AUTOMATIC FACILITY FOR RADIOGRAPHIC CONTROL OF FUEL RODS. Capuzzo, G.; Elementi, R.; Lanz, R.; Simonelli, G. (CNEN, Rome). Energ. Nucl. (Milan); 22: No. 2, 89-92(Feb 1975). (In Italian).

An automatic x-ray radiographic facility is described which was built at the Plutonium Plant of the Casaccia Nuclear Studies Center of CNEN, and is used for the quality control of fuel rods of both thermal and fast reactors. The facility allows about 200 rods per day to be inspected. (auth)

22252 ELECTROACOUSTIC CONVERTER WITH A MAGNETOSTRICTIVE ELEMENT. Lauhoff, T. (to Internationale Atomreaktorbau GmbH). German(FRG) Patent 2,333,482/A/. 16 Jan 1975. 13p. (In German).

An electroacoustic converter, and in particular a receiver for body and liquid sound waves is described. With small dimensions, it is simple and robust, can be used at high temperatures, and also registers small values of acoustic pressure. (GE)

Nuclear Explosions

Refer also to abstract 22263.

22253 (AD-774801) MATERIAL PROPERTIES FOR POST-SHOT MIXED COMPANY ANALYSIS: RECOMMENDATIONS BASED ON RECENT LABORATORY AND IN SITU TEST DATA. Final Report. Ehrgott, J. Q.; Jackson, J. G. Jr. (Army Engineer Waterways Experiment Station, Vicksburg, Miss. (USA)). Jan 1974. 80p. (CONF-7305112-1). NTIS $4.00.

From Defense Nuclear Agency strategic structures long-range planning meeting; Menlo Park, California, USA (15 May 1973).

The results of a reevaluation of the Mixed Company site profile and constitutive properties using both field and laboratory data are presented. Revisions to the subsurface profile were based primarily on the water contents determined in the soil overburden at shot time. An extensive reanalysis of the seismic velocity data was conducted. New constitutive property recommendations for the overburden soil were developed based on laboratory tests conducted on specimens taken in the field just a few days after the event. The properties of the Kayenta Formation were revised to consider the effect of loading rate on the initial portion of the uniaxial strain (UX) test stress-strain curves, the effects of anisotropy on the observed triaxial shear (TX) and UX test behaviors, and the correlation observed between shear strength obtained from laboratory tests and strength obtained from an in situ test. (GRA)

22254 (AD/A-001942) RESEARCH IN SEISMOLOGY AND INFRASONIC ACOUSTIC WAVES. Final Report, 15 September 1971–30 June 1974. Cabre, R. (Observatorio San Calixto, La Paz (Bolivia)). Aug 1974. 93p. NTIS $4.75.

Research is reported on the following: Meteorological relations to infrasonic acoustic waves; yield of atmospheric nuclear test measured through infrasonic records; optimum inlet configuration in a noise reducing array; coupling of seismic and atmospheric waves; seismicity in some towns according to magnitudes calculated by NOAA; PCP phase; Nazca plate and its geodynamic implications; P-time residuals and the low velocity channel underneath the Central Andes; and seismic attenuation across Central Andes. (GRA)

22255 (UCID-16867) QDAC: A COMPUTERIZED VERSION OF THE BOTE MODEL. Kurtz, S. R.; Schooler, E. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Aug 1975. Contract W-7405-eng-48. 84p. Dep. NTIS $7.25.

The use of the QDAC program to solve the BOTE equations which predict the arrival times, peak stresses, and velocities associated with the diverging stress wave from an underground explosion is explained. The method of running, input required and output provided by QDAC are described. A sample problem is described in some detail. (auth)

22256 (UCRL-50016-75-2, pp 20-21) DOWNHOLE CABLE CONNECTOR. Barlow, T. M.; Ruffner, D. J. 1975.

In mechanical engineering department. Quarterly report: April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

The electrical cables that run from the ground surface to an emplaced system such as a nuclear explosives can be subjected to very high downhole pressures and temperatures. These conditions create problems in making trouble-free cable connections. They can make cable components buckle inside the connector or can indirectly damage the rubber boot surrounding the connector, allowing water to leak in. An electric cable connector that deals with these problems is described. The connector is very effective both in high-pressure environments and at high-pressure, low-pressure interfaces. It can readily be adapted for use with multiple cables or with cables with multiple conductors and can be used with any downhole package. (TFD)

22257 (USGS-474-181) CALCULATION OF IN SITU PRINCIPAL STRESS USING SECONDARY PRINCIPAL STRESS. Brethauer, G. E.; Rosenbaum, J. G. (Geological Survey, Denver, Colo. (USA)). Jul 1975. 29p. Dep. NTIS $4.00.

A method is derived to determine principal stress magnitude and orientation at a particular location by using calculated secondary principal stresses that were obtained from overcoring stress relief measurements. A computer program based on this method is used to calculate the principal stress at various locations in Rainier Mesa, Nevada Test Site, using previously reported secondary principal stress values. (auth)

22258 (WASH-1526(Suppl.)DRAFT) Underground Nuclear Testing Program. (Energy Research and Development Administration, Washington, D. C. (USA)). Jun 1975. 47p. USERDA, Washington, DC.

This Supplement extends the Environmental Statement (WASH-1526) to cover all underground nuclear tests and preparations for tests of one megaton (1 MT) or less at the Nevada Test Site (NTS) during Fiscal Year 1976. If nuclear excavation tests or tests of yields above 1 MT should be planned, these will be covered by separate environmental statements. The test activities covered include chemical high explosive detonations done in connection with the nuclear testing program. (auth)

22259 PEACEFUL APPLICATIONS OF UNDERGROUND NUCLEAR EXPLOSIONS. Thomas, K. T. (Bhabha Atomic Research Centre, Bombay (India). Engineering Services Group). Nucl. India.; 12: No. 11, 4-8,2-3(Jul 1974).

5 figures, also published in India J. Power River Val. Dev. (Jul 1974) v. 24(7) p. 195-200.

The phenomenology of underground nuclear explosions is described. Two types of cavity formation are shown, i.e., the "chimney" type for deep underground explosions and the "crater" type for explosions not so deep. The various applications of underground nuclear explosions in the field of development of natural resources are enumerated. In view of the present oil crisis emphasis is placed on gas and oil stimulation by nuclear explosion technology. The possible applications of these detonations underground for releasing geothermal energy, which can later be used for power production, is indicated. (INIS)

Protective Structures and Equipment

22260 (CONF-731218-P2) SEMINAR ON IODINE FILTER TESTING, KARLSRUHE, W. GERMANY, 4–6 DECEMBER 1973. Volume II. (Commission of the European Communities, Luxembourg). Nov 1974. 100p. (In several languages).

From seminar on the testing of iodine filters; Karlsruhe, F. R. Germany (4 Dec 1973).

As announced in Vol. I of the "Proceedings of the Seminar on Iodine Filter Testing", a summary of the discussions which took place during the technical sessions is presented. The Chairmen of sessions I-IV have provided a critical analysis of and commentary on those discussions. The chapters "Basic Elements" and "Test Methods and Operational Experience" have also been published in the original French and German versions. In answer to many requests, an English translation of a basic seminar paper on "Behavior of Iodine Sorption Materials" is also included. A separate abstract has been prepared for this translation. (TFD)

For an abstract of an individual section see: 22261.

22261 (CONF-731218-P2, pp 77-100) BEHAVIOUR OF IODINE SORPTION MATERIALS. Wilhelm, J. G. (Gesellschaft fuer Kernforschung, Karlsruhe, Ger.). Nov 1974.

From seminar on the testing of iodine filters; Karlsruhe, F. R. Germany (4 Dec 1973).

In seminar on iodine filter testing. (Commission of the European Communities, Luxembourg).

All iodine compounds to be found in the air vented from nuclear power plants are given. The chemical reactions by means of which fission-product iodine is retained by the sorption materials used are explained briefly. The importance of the main parameters affecting the layout of sorption beds, such as type and grain size of the sorption material and relative humidity and temperature of the carrier gas, is discussed with reference to experimental results. Experiences on the dependence of the retention efficiency on the concentration of elementary iodine and methyl-iodide in the air are reported. The results are given of service life experiments on the ageing and poisoning of the sorption material and measures to prolong service life are discussed. (auth)

22262 (CONF-741001-) CUBE SYMPOSIUM, LAWRENCE LIVERMORE LABORATORY, OCTOBER 23–25, 1974. Symposium Proceedings. Westbrook, R. W. (ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1974. 582p. Dep. NTIS $13.60.

One hundred and two (102) papers and summaries were presented at the conference. A separate abstract was prepared for 8 papers. Eleven papers have appeared previously in NSA. For abstracts of these papers see 31: 3242, 31: 7998, 31: 8448, 31: 11100, 31: 19511, 31: 19526, 31: 19527, 31: 20568, 31: 26330, 31: 29748, and 31: 32457. The remaining 83 papers, covering various topics on the use of computers to advance engineering technology, are not in scope for NSA. (RCK)

For abstracts of individual papers see: 21815, 22263, 22963, 22984, 22985, 23000, 23001, and 24118.

22263 (CONF-741001-, pp 80-86) FINITE ELEMENT ANALYSIS OF AN UNDERGROUND PROTECTIVE TEST STATION SUBJECTED TO SEVERE GROUND MOTION. Burchett, S. N.; Milloy, J. A.; Von Riesemann, W. A. (Sandia Labs., Albuquerque, NM). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium Proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

A recoverable test station, to be used at a location very close to the detonation point of an underground nuclear test, was designed and tested. The design required that the station survive the very severe free-field stress and that the acceleration of the station be limited to a tolerable level. The predicted magnitude and time history of the free-field stress and acceleration indicated that the volcanic tuff medium and the materials of the proposed structure would exhibit nonlinear behavior, so that a transient dynamic analysis of a composite type structure involving nonlinear materials and large deformations was necessary. Parameter studies using a linear elastic dynamic finite element technique were first done to gain an understanding of the effect of the material properties and to study the response of various configurations of the protective structure to the transient loading. Based upon the results of these parameter studies and upon fielding considerations, a tentative design was chosen. This design was then evaluated using a newly developed finite element computer program. The results obtained from this analysis are compared to the field test results. (auth)

22264 (CONF-750822-2) DECOMMISSIONING OF THE FISSION PRODUCT DEVELOPMENT LABORATORY AT HOLIFIELD NATIONAL LABORATORY. Schaich, R. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 23p. Dep. NTIS $4.25.

From conference on decontamination and decommissioning of ERDA facilities; Idaho Falls, Idaho, USA (19 Aug 1975).

The decontamination of the Fission Product Development Laboratory at Holifield National Laboratory was initiated in FY 1975 after 17 years of processing fission product waste streams to produce commercial quantities of ^{90}Sr, ^{137}Cs, ^{144}Ce, and ^{147}Pm. The objective of the decommissioning program is the removal of all radiation and contamination areas in the facility to a level which will be compatible with the environment in the foreseeable future. The initial phase of the decommissioning of the Fission Product Development Laboratory has been accomplished by reducing the radioactive content in the facility by a factor of 10^3. The intermediate phase of reducing the curie quantities of fission products by an additional factor of 10^3 will require considerable personnel exposure and direct contact type of operations. The final phase of shielding and sealing to acceptable levels of radiation and contamination can be accomplished with a minimum of personnel exposure. A substantial monetary investment will be required to allow a complete shutdown of the facility. (TFD)

ENVIRONMENTAL AND EARTH SCIENCES

22265 (LBL-3217) TRACE CONTAMINANTS IN THE ENVIRONMENT. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1974. 375p. (CONF-740836-). Dep. NTIS $10.60.

From 2nd annual NSF-RANN trace contaminants conference; Pacific Grove, California, USA (29 Aug 1974).

Separate abstracts were prepared for two papers presented at the conference. An additional 46 papers were presented on various aspects of trace contamination of the environment. (HLW)

For abstracts of individual papers see: 22668 and 22669.

22266 THERMAL ALTERATION OF AQUATIC ECOSYSTEMS. Gibbons, J. W.; Sharitz, R. R. (Savannah River Ecology Lab., Aiken, SC). Am. Sci.; 62: No. 6, 660-670(1974).

Studies on effects of thermal effluents from Savannah River Plant nuclear production reactors on aquatic communities are discussed. Since cooling towers are not used, the effluents are discharged directly into the aquatic ecosystems creating environments with temperatures ranging to above 50°C. Species elimination in the heated area is discussed with regard to trees, fishes, reptiles, and insects. There was a reduction in species diversity, although in certain communities eliminated species were replaced by others. Community resilience was exhibited among plants and animals in areas of reduced thermal stress. Thermal tolerance of certain species populations is discussed. Life history patterns of some species in heated areas were strikingly altered. Studies on post-thermal recovery areas showed that recovery from thermal loading was slow; the species diversity and evenness of one post-thermal community was similar to the natural community but species composition was different. (HLW)

Minerals and Ores

Refer also to abstract 23923.

22267 (LIB/Trans-559) SUPPLY OF THE EUROPEAN COMMUNITY COUNTRIES WITH ENRICHED URANIUM. Translated by U. Engelbert from Atomwirtsch., Atomtech.; 19: 560-561(Nov 1974). 4p. Dep. NTIS (US Sales Only) $4.00.

A discussion is given of a survey regarding the supply of enriched uranium to the countries of the European Community. Costs of enriched uranium imports were not available but import values were calculated using world market prices. (AT)

22268 (NP-20509) GEOLOGICAL EXPLORATION OF URANIUM DEPOSITS IN THE BURGOS VALLEY. Valdez, M. E. C. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Ingenieria y Arquitectura). 1975. 82p. (In Spanish). Dep. NTIS (US Sales Only) $7.25.

Thesis.

The results of the geological exploration of U deposits are reported. The regional geology is defined in some detail. The geological characteristics of the U deposits in the sedimentary rocks and the chemical and physical conditions for their formation are analyzed. The sequence to be followed in the exploration of the sedimentary deposits is outlined. The location of possible ore deposits and the area to be explored in detail are described. (JSR)

22269 SPECIFIC FEATURES OF THE URANIUM BOND WITH PHOSPHORITE PHOSPHATES OF THE RUSSIAN PLATFORM. Kozlov, A. A. (All-Union Scientific Research Inst. of Nuclear Geophysics and Geochemistry, Moscow). Geokhimiya; No. 3, 472-475(Mar 1975). (In Russian).

In the phosphate of the phosphorite concretions of the Central Russian Platform the uranium content varies from 22 to 32×10^{-4}%, reaching a concentration of 50×10^{-4}% in the sections that are richest in organic matter. The uranium content in bone phosphate from fossil reptiles is uniform along the surface of bone tissue, 35 to 40×10^{-4}%. From noncrystalline bone phosphate to the completely crystalline modification there occurs a displacement of uranium compounds and a decrease in their concentration to 0.2×10^{-4}%, i.e., 200-fold. Assuming that uranium in phosphate is found primarily in non-mineral forms, its content in phosphorites is close to the average content in the earth's crust. (tr-auth)

22270 ORIGIN OF WHEWELLITE IN A HYDROTHERMAL URANIUM DEPOSIT. Galimov, E. M.; Tugarinov, A. I.; Nikitin, A. A. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Geokhimiya; No. 5, 676-683(May 1975). (In Russian).

Hydrothermal whewellite sharply differs in isotopic composition ($\delta^{13}C$ from −1.56 to −2.22‰) from the diagenetic one ($\delta^{13}C$ + 0.7‰). In terms of notions about the ordered intramolecular carbon isotope distribution in organic compounds it is shown that the studied whewellite is a product of oxidation–reduction reactions proceeding in the hydrothermal solution with the participation of organic matter. The conclusion is drawn that on the one side occurred a reduction of hexavalent uranium with its precipitation in the form a pitchblende, on the other side occurred a formation of oxidized forms of organic matter, in particular of oxalic acid with subsequent oxalate precipitation in the form of whewellite. (auth)

22271 URANIUM, THORIUM, AND POTASSIUM DISTRIBUTION IN DEPOSITS OF THE WESTERN-SIBERIAN PLATFORM. Pluman, I. I. (Geological Board, Novosibirsk, USSR). Geokhimiya; No. 5, 756-767(May 1975). (In Russian).

The distribution of natural radioactive elements (NRE)–uranium, thorium and potassium in Mesozoic–Cenozoic deposits of the Western-Siberian platform is described. Uranium-bearing bituminous argillites of the Bazhenov series of the Volga stage expanding over an area about 1 mln·km² have been described in more detail. The content of NRE is equal to the average NRE content in analogous rocks of other similar regions. (auth)

22272 URANIFEROUS REGION OF CUNHA BAIXA; QUINTA DO BISPO (CENTRAL PORTUGAL). Matos Dias, J. M.; Costa, C. V. B. (Univ. of Coimbra). Publ. Museu Lab. Mineral. Geol. Univ. Coimbra Centro Estud. Geol., Mem. Notic.; No. 73, 26-47 (1972). (In French).

The Cunha Baixa—Quinta do Bispo region covers an area of 14 sq km and is located in the Viseu district, central Portugal. In this region three different types of hercynian granitic rocks could be mapped. The intensive metasomatic reorganization of pelittic rocks that has undergone a previous thermal-metamorphism, together with the abundance of aplites and pegmatites are considered as local evidence of an important endomagmatic stage during the granitic differentiation. The two sets of shear conjugated fractures prevalent in this area strike NE and NNW and they experiment local deviation due to retraction when they cross rock masses boundaries. These structural features were individually and statistically investigated both in the field and in aerial-photographs. The various methods of prospecting applied during the general, regional and local surveys of this area are summarily described. Evidence was obtained of several indices of mineralisation and the definition of a few ore deposits, both of vein type and dissemination type. The ore deposit of Cunha Baixa that stands now as one of the most important Portuguese uranium deposits is described. An ultimate supergenetic origin correlated with biosthasic processes is considered the best hypothesis to explain these ore-deposits. (auth)

Radioactive Effluents

Refer also to abstract 23550.

Radioactivity Monitoring and Transport

Refer also to abstracts 22305, 22366, and 23960.

22273 (ORP/CSD-5-1) PROCEEDINGS OF PUBLIC HEARINGS: PLUTONIUM AND THE OTHER TRANSURANIUM ELEMENTS, WASHINGTON, D. C., DECEMBER 10–11, 1974. Volume 1. (Environmental Protection Agency, Washington, D. C. (USA). Office of Radiation Programs). 1974. 866p. (CONF-741244-P1). Environmental Protection Agency, Washington, DC.

The Environmental Protection Agency embarked on a program to evaluate the environmental impact of the transuranium elements and to consider whether further guidelines or standards are needed to assure adequate protection of the general ambient environment and of the public health from potential contamination of the environment by radionuclides of these elements. Public hearings were held in Washington, D. C., and Denver, Colorado, to gather information regarding the public and social implications of plutonium utilization; the factors involved in the balancing of costs vs benefits; dosimetry, health, and environmental effects; environmental levels and pathways; applications using plutonium;

and control and cleanup technology. The proceedings of the hearing in Washington, D. C., Dec. 10-11, 1974, are presented. Data are included on current and potential sources of transuranium elements in the environment; animal studies on the tissue distribution of ^{233}U, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{241}Am, ^{244}Cm, ^{249}Bk, ^{252}Cf, and ^{253}Es and pathological effects of body burdens of these radionuclides; and data on the health status of personnel known to have body burdens of ^{238}Pu or ^{239}Pu acquired during acute or chronic exposure, many of them over 30 years previously. It is pointed out that the lack of demonstrable biological effects of Pu in man provides presumptive evidence that the radiation protection standards in effect are adequate. (CH)

22274 (TID-26794(Rev.)) HAZARDS IN PLUTONIUM DISPERSAL. Cohen, B. L. (Pittsburgh Univ., Pa. (USA)). Jul 1975. 48p. Dep. NTIS $5.50.

The health hazards to human populations from the dispersal of Pu in the environment are reviewed. Meteorological, and other factors, affecting the migration of Pu through soil-plant food chains to man are discussed, and an estimate is presented for the rate of cancer induction following ingestion of levels of ^{239}Pu that may be present in foods. The lethal dose of inhaled ^{239}Pu in personnel was also estimated. (CH)

22275 OBSTINATE FISSION PRODUCT. McKay, H. A. C. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Chem. Eng. (London).; 11: No. 7, 257-259(Jul 1975).

Consideration is given to problems presented by fission product Ru in effluent discharges from UKAEA fuel processing plants. The discussion includes consideration of Ru coordination compounds and in particular the nitrato- and nitro-complexes of nitrosylruthenium (III). The isotope of main concern is ^{106}Ru, which has a half-life of 1 year and which emits energetic β- and γ-rays. The behavior of fission product Ru in the environment is discussed, with particular regard to seaweed and laver bread. Authorized discharge limits are also discussed. (UK)

22276 EXPERIMENTAL STUDY OF ^{90}Sr MIGRATION IN THE SOILS OF FOREST BIOGEOCOENOSES. Molchanova, I. V.; Kulikov, N. V.; Piskunov, L. I. (Inst. of Plant and Animal Ecology, Ural, USSR). Sov. J. Ecol. (Engl. Transl.); 4: No. 5, 416-419 (Jul 1973).

Translated from Ekologiya; 4: No. 5, 61-65(1973).

The migration and distribution of ^{90}Sr in forest soils was studied in adjacent sections of a mountain landscape by introducing radionuclide into the forest floor and by analyzing global radioactive fallout. The area of ^{90}Sr dissemination within the soil profile of forest biogeocoenoses was found to be larger in the middle part of the slope and at its foot than at the top of the ridge. The radionuclide's vertical distribution in soils is satisfactorily approximated by an exponential function with both artificial and global contamination of biogeocoenoses. (auth)

Atmosphere

Refer also to abstract 22299.

22277 (PTB-Ra-1) INFLUENCE OF CHINESE NUCLEAR WEAPONS TESTS ON THE RADIONUCLIDE CONCENTRATION IN THE AIR AT GROUND LEVEL. Kolb, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Radioaktivitaet). Jul 1971. 20p. (In German). INIS.

Aerosol specimens collected monthly in the Physikalisch-Technische Bundesanstalt in Braunschweig are used to obtain a general view of the concentration of medium- and long-lived radionuclides produced by Chinese nuclear weapons tests. The activity concentration of radionuclides with half-lives over 200 days was only insignificantly affected by the tests. In 1968, 1969, and 1970, activity peaks due to thermonuclear tests were recorded. The activity concentrations of all radionuclides in the experiments were at least 3 classes lower than the maximum doses for the total population. (GE)

22278 RADON CONCENTRATION OF AIR OVER THE EASTERN ARABIAN SEA. Bhat, S. G.; Krishnaswami, S.; Rama (Tata Inst. of Fundamental Research, Bombay (India)). Proc. Indian Acad. Sci., Sect. A; 80: No. 3, 109-115(Sep 1974).

The radon concentrations of air samples collected during the South West monsoon period at altitudes up to 4 km over the Arabian Sea at two locations, i.e., 0 to 50km and 300 to 400km west of Bombay, are reported. Radon was extracted from air, using a simple single stage apparatus. The concentration of radon in the monsoon air mass was found to range around 80 to 100 dpm/m^3 STP, indicative of its recent continental origin. The results suggest that the coastal monsoon air mass, up to 400 km west of Bombay coast, is generally homogeneous and vertically well mixed. During the post-monsoon condition, a strong gradient in the radon concentration in the vertical is observed. The concentration of radon decreases from 157 dpm/m^3 at sea level to 35 dpm/m^3 at about 3.7 km altitude, suggesting a vertical turbulent diffusion coefficient of $\sim 6 \times 10^4$ cm^2/sec. In contrast, the near absence of vertical gradient of radon in the monsoon air mass indicates that the vertical turbulence is much stronger during the monsoon period. (auth)

22279 RADIOACTIVITY IN THAILAND. Bhodigen, S. (Chulalongkorn Univ., Thailand). J. Nat. Res. Counc. Thailand; 7: No. 1/2/3/4, 24-30(1975). (In Thai).

In order to check the presence of radioactivity in Thailand, radioactivity of soil, plants, water, and air was measured. It is found that soil, plants, and water have normal levels of radioactivity compared with those measured in other countries. Analysis of rain water and air indicates that since air masses coming into Thailand from the north or northeast usually blow out of Siberia, Thailand will receive fallout from nuclear weapons tests in Siberia in the winter time. (auth)

22280 DIURNAL VARIATIONS OF RADON AND METEOROLOGICAL VARIABLES NEAR THE GROUND. Li, Ta-Yung. (Drexel Univ., Philadelphia). Boundary-Layer Meteorol.; 7: No. 2, 185-198(Oct 1974).

Radon is an excellent tracer for the study of transport processes in the lower atmospheric boundary layer. Analyses of the radon data measured on a 300-m meteorological tower at Philadelphia show that the diurnal variation of atmospheric turbulence is closely related to the meteorological variables. A model of variation of radon concentration with mean wind speed and low-level vertical temperature difference is derived. It indicates that radon concentration is inversely proportional to the mean wind speed and directly proportional to the temperature difference. These predictions are in good agreement with the measurements. (auth)

Soil

Refer also to abstracts 22961 and 22962.

22281 (LBL-3646) STATUS OF THE GEODOSE PROJECT. Wollenberg, H. A.; Fitzpatrick, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-eng-48. 17p. (CONF-750671-1). Dep. NTIS $4.00.

From international symposium on areas of high natural radioactivity; Pocos de Caldas, Brazil (16 Jun 1975).

The evaluation of the impact of man upon the natural gamma-radiation environment requires a clear understanding of the distribution and abundance of the natural radioelements in rocks and soils. The GEODOSE Project is an attempt to characterize rock and soil types by their natural gamma-ray exposure rates. The world's geochemical literature is being searched for data on K, U, and Th contents of earth materials, and these data are categorized by rock type, based on standard petrologic classifications. A data bank is being assembled, presently incorporating radioelement information on the igneous rocks. The data are treated to produce computer plots of histograms of K, U, Th contents, calculated gamma-ray exposure rates, and radiogenic heat production for given rock types. (auth)

Water

Refer also to abstract 22351.

22282 MAN-MADE PLUTONIUM IN FRESHWATER AND MARINE ENVIRONMENTS. Krishnaswami, S. (Physical Research Lab., Ahmedabad (India)). Proc. Indian Acad. Sci., Sect. A; 80: No. 3, 116-123(Sep 1974).

13 refs.

Significant concentrations of plutonium isotopes are found in lake and coastal marine sediments accumulating at rates of 1 to 5 mm/yr. The activity levels of $^{239,240}Pu$ range between 0.7 to 3.3 dpm/g for post 1960 sediments. The measured and the calculated integrated activities of ^{239}Pu in the lake sediments are in agreement. This suggests that plutonium is chemically reactive in freshwater environments and it is removed to sediments from the water column shortly after its injection. A delay of about three years has been observed between the peak of plutonium fallout and its incorporation in the varved sediment from Santa Barbara basin. Based on this observation the mean size of particles transporting plutonium to the basin sediments is estimated to be about three microns. The usefulness of plutonium isotopes as a tracer nuclide for estimating sedimentation rates for the last two decades have been evaluated. (auth)

Ecosystems and Food Cycles

Refer also to abstracts 21816 and 21817.

22283 (NP-20444, pp 42) STUDY OF RARE AND RADIOACTIVE CONSTITUENTS PRESENT IN SAMPLES OF INDIAN TOBACCO. Purkayastha, B. C.; Bhattacharyya, D. K. 1972. In Saha Institute of Nuclear Physics annual report, 1972.

22284 (SAAS-175) DETERMINATION OF ACCUMULATION FACTORS, FISH/WATER, FOR RADIONUCLIDES CONSIDERED TO BE SIGNIFICANT FOR RADIATION EXPOSURE OF MAN. Ettenhuber, E.; Clajus, P.; Roehnsch, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Mar 1975. 20p. Dep. NTIS $4.00.

Data are presented on the accumulation of ^{90}Sr, ^{137}Cs, Ra and U by various species of fish captured in waters on the territory of the GDR. Fishes feeding on small fish have higher accumulation factors than fishes feeding chiefly on benthic invertebrates. There is a negative correlation between the accumulation factors of ^{137}Cs and the K content of the water. In the same manner the accumulation factors of ^{90}Sr and Ra are dependent upon calcium. The accumulation factors of ^{137}Cs were found to be 2 to 3 orders of magnitude over those of ^{90}Sr. (auth)

22285 MEDICAL RADIONUCLIDES IN MARINE ENVIRONMENT. Birks, J. L. (Singleton Hospital, Swansea, Eng.). Nature (London).; 255: No. 5510, 621-622(19 Jun 1975).

It is stated that with the recent rapid increase in the medical use of radionuclides, concern has arisen regarding environmental contamination by radioactive wastes, particularly of public sewage systems. Some studies made in the Swansea (UK) area are described; the nuclides of the greatest relevant importance in this area appear to be ^{131}I and ^{99m}Tc. After entering the public sewage system the wastes from the Swansea hospitals pass through a mechanical screening and maceration process and are then discharged into the sea. Some data are given for the radioiodine content of some common seaweeds which had reached long term steady-state equilibrium, and in addition short term uptake tests were carried out for ^{131}I and ^{99m}Tc. The seaweeds showed a remarkable avidity for the two radionuclides. The ^{131}I content of seaweed specimens from beaches near the sewage outfall was measured and compared with samples of the same species from remote beaches. The results indicated large safety margins, and in the case of ^{99m}Tc it is not likely that any health hazard will result from its use, since it has a short half life and low radiotoxicity. (UK)

22286 RADIATION HAZARD OF ^{129}I. Moskalev, Yu. I.; Vasilenko, I. Ya. Gig. Sanit.; No. 2, 80-83(Feb 1975). (In Russian).

The occurrence of iodine, its entry into the body, the accumulation of ^{129}I in reactors, global fallout date, iodine exchange in the biosphere, and sources of local iodine accumulations are reviewed. (5 references) (TTT)

22287 NEW NORMAL RANGES FOR THE RADIOIODINE UPTAKE IN TIDEWATER, VIRGINIA. Fitzer, P. M. (Riverside Hospital, Newport News, VA). Va. Med. Mon.; 101: No. 11, 948-950(Nov 1974).

The new mean value for the normal 24 hour radioiodine uptake in Tidewater, Virginia is 12.8 percent. The euthyroid range is set at 5 to 33 percent. Reasons for the overlap of the hypothyroid and euthyroid values are discussed. (auth)

Radiometric Techniques

Refer also to abstract 22403.

22288 (STI/DOC-10/168) RADIATION TECHNIQUES FOR WATER-USE EFFICIENCY STUDIES. Results of a Five-Year Coordinated Research Program. (International Atomic Energy Agency, Vienna (Austria). Joint FAO/IAEA Div. of Atomic Energy in Food and Agriculture). 1975. 231p. IAEA $9.00.

The primary objective of this program was to integrate and direct the technologies of agronomy and soil science related to crop-water requirements, and irrigation and drainage criteria, towards the goal of increasing water-use efficiency in arid and semi-arid regions where water is the main limiting factor for agricultural production. This objective was ambitious, inasmuch as the various techniques had not been universally tested nor had previous attempts been made to develop standardized procedures applicable to the several locations having different soil and climatic conditions. In addition, two devices—the yet-to-be-proven neutron moisture meter and a newly designed weighable lysimeter system—were examined under the most practical conditions in the field. They were examined during long periods of continued usage with little or no opportunity for repair or improvement. (auth)

22289 RADIOACTIVE ANOMALIES AS TRACERS OF ORE PROCESS. Ostrovskii, E. Ya. Dokl. Akad. Nauk SSSR; 221: No. 1, 201-204(1 Mar 1975). (In Russian).

Variations in the radioactivity detected by aerial surveying in a thin surface layer about 30 cm thick is a valuable indication of mineral deposits of Ta, Be, Mo, Sn, Au and other nonradioactive minerals. It is noted that the probability of finding a mineral deposit by aerial surveying is related to the dominance of a single radioactive element (K, Th or U) above the background reading of these elements. The probability of finding a mineral deposit also increases with a decrease in radioactivity below the background level. A computer is used in detecting the radioactive anomalies. Data are presented for the detection of a gold-silver deposit and also for a bauxite deposit. This method of detecting radioactive anomalies from the dominance of U, Th or K radioactivity can be used to detect other ore bodies. (SJR)

22290 DETERMINATION OF RESERVOIR GROUPS IN THE SAND CLAY SECTION OF RED BEDS IN THE SOUTH-WEST TURKMENIYA FROM THE COMMERCIAL GEOPHYSICAL DATA. Akent'ev, E. P.; Kireev, V. F.; Mechetin, V. F. Uch. Zap. Azerb. Inst. Nefti Khim.; No. 4, 10-15(1973). (In Russian).

Results obtained in γ well logging in petroleum prospecting are reported. (JSR)

22291 RADIOTRACER INVESTIGATION ON THE EFFECT OF SULPHATE AND PHOSPHATE APPLICATION ON PADDY. Acharya, N. (I. R. C., Chakuli, Sambalpur, India). Indian J. Agric. Chem.; 6: No. 1, 23-32(Jan 1973).

Effect of application of sulphate at four levels (0, 30, 60, and 90 ppm S) and phosphate at three levels (0, 30, and 60 ppm P) applied in the form of ammonium sulphate labelled with ^{35}S and monocalcium phosphate respectively to paddy crop in soils collected from Sambalpur, Cuttack. Bhubaneswar from Orissa and Nagpur from Maharastra in a pot culture experiment was studied. Sulphate application beyond 60 ppm S had significantly decreased the yield of dry matter in all other soils except that from Bhabaneswar where a decrease in yield had been noticed. Phosphate application had significantly increased the uptake of sulphur throughout but sulphate application increased the uptake of P until a significant adverse effect on yield was observed. The average "A" values of sulphur for these soils obtained by radioassay method were found to be 93, 128, 84, and 79 ppm., respectively and the optimum limits of sulphur in these soils for maximum dry matter yield of paddy was obtained by adding 60 ppm sulphur to respective "A" values. There was no significant effect of interaction on yield except in Nagpur soil. Utilization of native sulphur was found to increase due to application at all levels and sulphur application up to 30 ppm beyond which more of fertilizer sulphur had been utilized. (auth)

22292 RELATIVE FLOW RATES OF THE NEGRO AND SOLIMOES RIVERS THROUGH ^{18}O CONCENTRATIONS. Matsui, E. (Centro de Energia Nuclear na Agricultura, Sao Paulo, Brazil); Salati, E.; Brinkmann, W. L. F.; Friedman, I. Acta Amazonica; 2: No. 3, 31-46(Dec 1972). (In Portuguese).

Isotopic concentration was detected in different spots of Rio Negro, Rio Solimoes, and Rio Amazonas at regular intervals, for 12 consecutive months. Values as found in Rio Negro waters were significantly different. Difference between isotopic concentration found in Rio Negro and Rio Solimoes was considered as useful information for identifying the spot where Rio Amazonas, formed by the confluence of Negro and Solimoes, presents a homogeneous vertical and horizontal structure after complete mixing of both rivers. A perfect mixture was not found up to 120km below the confluence. Systematic sampling was found to be a method for the determination of relative outflow of both rivers. Data as obtained are close to the results of direct measurements performed elsewhere. (INIS)

Site Surveys

22293 (PRNC-187) CABO ROJO PLATFORM ENVIRONMENTAL STUDIES. Wood, E. D.; Youngbluth, M. J.; Yoshioka, P. (Puerto Rico Nuclear Center, Mayaguez). 15 May 1975. Contract AT(40-1)-1833. 78p. Dep. NTIS $7.00.

For Puerto Rico Water Resources Authority.

A survey was made of an offshore site in the Caribbean Sea off southwest Puerto Rico to provide data upon which to judge the suitability of the site for the construction of power generating facilities and to allow the determination of the impact of construc-

tion and operation of the facility on the environment. Data are presented on the physical, chemical, and geological parameters of the site, the biomass of zooplankton, and the species of benthic invertebrates, fishes, and plants in samples of seawater. (CH)

22294 (USGS-474-208) GEOLOGY OF THE UE12n NO. 6 VERTICAL DRILL HOLE, NEVADA TEST SITE. Fairer, G. M. (Geological Survey, Denver, Colo. (USA)). 1975. 27p. Dep. NTIS $4.00.

The UE12n no. 6 vertical drill hole is located on Aqueduct Mesa, Nevada Test Site, Nevada State coordinates N. 891,000, E. 631,250, at an elevation of 2,261.6 m (7,420 ft), and was drilled to a total depth of 706.2 m (2,317 ft) between Oct. 2 and Nov. 4, 1973. It is the first hole on the mesa in which bedded and ash-flow tuffs of Area 20 and bedded tuffs of Dead Horse Flat have been identified. The boring penetrated in stratigraphic sequence the Rainier Mesa Member of the Timber Mountain Tuff (top), Paintbrush Tuff, Stockade Wash Tuff, bedded and ash-flow tuffs of Area 20, tuffs of Dead Horse Flat, Grouse Canyon Member of the Belted Range Tuff, tunnel beds 3-5, Tub Spring Member of the Belted Range Tuff, tunnel bed 2, and Crater Flat Tuff (base), all of Tertiary age. Apparent dips of bedding planes measured on core range between 4^0 and 12^0, and average 9^0. The drill hole cut numerous small fault and fracture zones; however, recent surface mapping indicates none of the faults reaches the surface of the mesa. Included are a location map and a figure showing lithologic and stratigraphic logs, core index, and resistivity. A detailed lithologic description is included in table 1. (auth)

Thermal Effluents

22295 (CONF-750425-7) GROWTH OF SALMONID FISHES FROM HEATED AND UNHEATED AREAS OF LAKE MICHIGAN: AS MEASURED BY RNA-DNA RATIOS. Spigarelli, S. A.; Smith, D. W. (Argonne National Lab., Ill. (USA)). 1975. 21p. Dep. NTIS $4.25.

From 2nd thermal ecology symposium; Augusta, Georgia, USA (2 Apr 1975).

Relative growth rate comparisons were made between tagged thermal plume resident fish and fish collected from two ambient temperature areas (control). Plume fish were tagged, released and subsequently recaptured in the thermal discharge area of the Point Beach Nuclear Plant (near Two Rivers, Wisconsin). Total tag days indicated minimum residence time and temperature-sensitive tags gave estimates of time spent at discharge temperatures. Growth rate estimates were based on RNA-DNA ratios in epaxial muscle samples taken from brown and rainbow trout and chinook salmon. Mean RNA-DNA ratios of plume rainbow trout and chinook salmon were not significantly different from mean ratios of combined control groups for each species. The mean ratio of plume brown trout was significantly higher than that of combined control fish. Significant differences between mean ratios of control groups for each species suggest considerable natural variability in growth rates among individuals of a population. (auth)

22296 (COO-2002-24) THERMAL REGULATION OF FUNCTIONAL GROUPS IN RUNNING WATER ECOSYSTEMS. Progress Report, 1974–1975. Cummins, K. W.; Klug, M. J. (Michigan State Univ., Hickory Corners (USA). W. K. Kellogg Biological Station). 1975. Contract E(11-1)-2002. 23p. Dep. NTIS $4.25.

Upper and lower thermal limits and temperature dependent growth were determined for a number of organisms (or populations) representing various functional groups of stream ecosystems (microconsumers, producers, and macroconsumers, shredders, collectors, scrapers, and predators). Although temperature functions as an overall control parameter, organic substrate (microconsumers) and inorganic nutrients (microconsumers and producers), light (producers) and food quality (macroconsumers) can modify thermal responses. Stream microorganisms typically grow below their thermal optima, community composition being determined by those that can manage the maximum growth at a given temperature utilizing a given organic substrate. Producers in first to third order streams are generally light limited (although nutrient availability is also important). Food quality, primarily a function of microbial biomass in the case of detritivores, can compensate for temperature dependent growth in non-predator macroinvertebrate functional groups. (auth)

22297 (DP-1385) SHORT CLIMATOLOGY OF THE ATMOSPHERIC BOUNDARY LAYER USING ACOUSTIC METHODS. Schubert, J. F. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jun 1975. Contract AT(07-2)-1. 20p. Dep. NTIS $4.00.

A climatology of the boundary layer of the atmosphere at the Savannah River Laboratory is being compiled using acoustic methods. The atmospheric phenomenon as depicted on the facsimile recorder is classified and then placed into one of sixteen categories. After classification, the height of the boundary layer is measured. From this information, frequency tables of boundary layer height and category are created and then analyzed for the percentage of time that each category was detected by the acoustic sounder. The sounder also accurately depicts the diurnal cycle of the boundary layer and, depending on the sensitivity of the system, shows microstructure that is normally unavailable using other methods of profiling. The acoustic sounder provides a means for continuous, real time measurements of the time rate of change of the depth of the boundary layer. This continuous record of the boundary layer with its convective cells, gravity waves, inversions, and frontal system passages permits the synoptic and complex climatology of the local area to be compiled. (auth)

22298 (DP-MS-74-77) PERIPHYTON CROPS AND PRODUCTIVITY IN A REACTOR THERMAL EFFLUENT. Tilly, L. J. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 42p. (CONF-750668-1). Dep. NTIS $5.25.

From 38th annual meeting of the American Society of Limnology and Oceanography; Halifax, Canada (23 Jun 1975).

Samples of periphyton grown for two weeks on microscope slides in surface waters of the reactor cooling reservoir, Par Pond, were examined for differences in species composition, diversity, standing crop, and ^{14}C uptake relatable to 7 positions in the thermal effluent. For stations which differed in average temperature by less than 5^0C, weight specific productivity differed by a factor of 7. Periphyton biomass differed more than fivefold between stations 5.5^0C apart. For most incubation intervals, both weight specific productivity and accumulated crop correlated highly with the average growing temperature, but slopes of regressions from consecutive periods often differed greatly while species composition and temperauture regime changed only slightly. Recent experiments indicate that observed differences may be due to interactions between nutrients and temperatures. (auth)

Chemical Effluents

Refer also to abstracts 21828, 21837, 22399, and 23550.

22299 (AERE-R-8038) SURVEY OF ATMOSPHERIC TRACE ELEMENTS IN THE U. K.: RESULTS FOR 1974. Cawse, P. A. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1975. 16p. Dep. NTIS (US Sales Only) $4.00. UK £1.00.

The concentrations of 28 trace and major elements were determined in air particulate, rainwater and dry deposition sampled continuously during 1974 at 7 non-urban sites in the U. K. The main objectives were to provide basic information on concentrations of elements in air to compare with urban measurements, to study the longer term trends in atmospheric concentrations, and to record the deposition inventory to the ground. The majority of samples were analyzed by instrumental neutron activation analysis. Absolute concentrations of elements in air at four sites were on average 25% lower than recorded in 1972-73. Seasonal effects were evident, and consistent elevated levels in autumn-winter were typically demonstrated. Previous classification of elements into low or high air enrichment (Ef) groups based on the air concentration results for 1972-73 was confirmed by the values for 1974. The general consistency of this annual parameter supports the concept of chemical uniformity of the aerosol. Air enrichment factors again showed an inverse relationship with Vg. Elements with low Ef (e.g., Al, Sc and Fe) were usually associated with particles having Vg 0.7–2.0 cm. sec^{-1}, while elements with Ef > 10 (e.g., Zn, As, Se, Sb and Pb) had Vg < 0.5 cm. sec^{-1}. Annual total deposition was comparable to that in 1972-73. The heaviest deposition of elements other than maritime-derived Na, Cl and Br was recorded at Styrrup, Notts: considering the cumulative 3-year deposit during 1972-74 at this station, Zn and Pb showed the greatest accumulation of all trace elements analyzed. Seasonal effects were noted at all sites for the total deposition of Na, Cl, Br and Pb, where the amounts deposited in the first and last quarters of 1974 were 1.8–3.5 times greater than in April–September. (auth)

22300 (UCRL-51837) TOWARD A MATHEMATICAL THEORY OF ENVIRONMENTAL MONITORING: THE INFREQUENT SAMPLING PROBLEM. Pimentel, K. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1975. Contract W-7405-eng-48. 404p. Dep. NTIS $10.60.

Thesis.

Optimal monitoring of pollutants in diffusive environmental media was studied in the contexts of the subproblems of the optimal

design and management of environmental monitors for bounds on maximum allowable errors in the estimate of the monitor state or output variables. Concise problem statements were made. Continuous-time finite-dimensional normal mode models for distributed stochastic diffusive pollutant transport were developed. The resultant set of state equations was discretized in time for implementation in the Kalman Filter in the problem of optimal state estimation. The main results of this thesis concern the special class of optimal monitoring problem called the infrequent sampling problem. Extensions to systems including pollutant scavenging and systems with emission or radiation boundary conditions were made. (auth)

INSTRUMENTATION

Radiation Detection Instruments

General Detectors and Monitors

Refer also to abstracts 21888, 21890, 22944, and 24031.

22301 (AEEW-M-1325) EFFECT OF MECHANICAL STRESS ON THE BENDING CRITERIA FOR MINERAL INSULATED CABLES. McMinn, K. W. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Jun 1975. 7p. Dep. NTIS (US Sales Only) $4.00.

Simple calculations of the permitted stresses in mineral insulated cable used on high temperature neutron detectors have been performed. The currently used storage coil diameters are justified and an assessment is made of the cable life under other likely service conditions. (auth)

22302 (ANL-CT-75-45824-0001) SUMMARY OF TEST RESULTS FROM EXPERIMENT NI-2 FOR THE RSN-286, S/N M402 AND THE WX-31384, S/N 703902 FISSION COUNTER-CHAMBERS BEING TESTED IN THE ERB-II NITF J-2 THIMBLE AT 900°F AND 1000°F, REACTOR RUNS 69 (FEBRUARY 1974) THRU RUN 74 (DECEMBER 1974); AND POST-IRRADIATION 700°F AND ROOM TEMPERATURE TEST RESULTS, DECEMBER 1974 AND MARCH 1975. Yingling, G. E. (Argonne National Lab., Ill. (USA)). 1 Jun 1975. Contract W-31-109-Eng-38. 100p. AT.

This report presents a summary of test results from the testing of two fission counter-chambers in the EBR-II J-2 thimble of the Nuclear Instrument Test Facility (NITF). The two fission counter-chambers being tested as Experiment NI-2 are a Reuter-Stokes Model RSN-286, S/N M402; and a Westinghouse Model WX-31384, S/N 703902. The intent of this report is to provide summary information on the detectors performance. This report covers the experiment test temperature increase from 800°F to 900°F in January 1974 and the following 900°F test temperature Reactor Runs 69 thru 71, the test temperature increase from 900°F to 1000°F in July 1974 and the following 1000°F test temperature Reactor Runs 72 thru 74, and the test temperature decreases to ~700°F, after Reactor Run 74, until the detectors were removed from the J-2 thimble in December 1974 and placed in storage. In addition, this report includes some post-irradiation room temperature results obtained in March 1975. (auth)

22303 (ANU-P-606) TABLES FOR CALIBRATION OF RADIATION DETECTORS. Bell, R. A. I. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 25 Dec 1974. 61p. Dep. NTIS (US Sales Only) $6.25.

A group of tables containing much useful information for calibrating radiation detectors is presented. Primarily, it is concerned with radioactive sources, giving information on radiation energies and intensities, but some other useful data is appended, e.g. on attenuations. Several of the tables are taken more-or-less directly from other publications. (auth)

22304 (BMFT-FBK-75-04) POLYCRYSTALLINE SEMICONDUCTOR PROBES FOR MONITORING THE DENSITY DISTRIBUTION OF AN INTENSE THERMAL NEUTRON FLUX IN NUCLEAR REACTORS. Graul, J.; Mueller, R. G.; Wagner, E. (Technische Univ. Muenchen (F. R. Germany). Inst. fuer Technische Elektronik). May 1975. 139p. (In German). Dep. NTIS (US Sales Only) $10.00.

The applicability of semiconductor detectors for high thermal neutron flux densities is theoretically estimated and experimentally examined. For good thermal stability and low radiation capture rate silicon carbide is used as semiconductor material, produced in polycrystalline layers to achieve high radiation resistance. The relations between crystallinity, photoelectric sensitivity and radiation resistance are shown. The radiation resistance of polycrystalline SiC-probes is approximately 100 times greater than that of conventional single crystal radiation detectors. For thermal neutron measurement they can be used in the flux range of approx. $10^{10} \leq \varphi_{n,th} \leq 5 \cdot 10^{13}$ ($cm^{-2}sec^{-1}$) with operation times of 1.6 a $\geq t_{b,max} \geq$ 30 d, resp. (auth)

22305 (BNL-16922) DIGITAL ENVIRONMENTAL MONITOR. Chester, J. D.; Chase, R. L.; Wood, S. (Brookhaven National Lab., Upton, N. Y. (USA); Rochester Univ., N. Y. (USA)). 1972. 18p. (CONF-720614-11). Dep. NTIS $4.00.

From 17th annual meeting of the Health Physics Society; Las Vegas, Nevada, USA (12 Jun 1972).

An instrument has been designed to replace the Dynamic Condenser Electrometer to measure the background radiation levels at the boundaries of Brookhaven National Laboratory. The detector is a 2" x 2" tin loaded plastic scintillator, whose energy response is air equivalent, coupled to a bialkali cathode 2" photomultiplier tube operated in the direct current mode. The output of the photomultiplier is digitized by a current to frequency converter, and the resultant pulses fed to a scaler. The system is programmed to calibrate itself once an hour to compensate for changes in photomultiplier tube gain to changes in temperature. During the calibration cycle a number, which is a function of the system's gain, is generated and held in a register, and is then used to weight the data accumulated between calibration cycles. The output data is stored on a six digit non-resetting printing register. The register, which can be programmed to print at any time interval desired, also prints the day of the year, time of day and station number. The instrument, which is calibrated to give 10 counts per mu R, has a minimum sensitivity of 1 mu R/hr and was designed so that it will not saturate at 10 mR/hr, making it useful in the event of an accidental high level activity release. The digital logic is accomplished by the use of integrated circuits mounted on printed circuit boards housed in NIM modules. The detector is housed in an aluminum weather tight container. Two of the units have been in operation for over a year with no significant maintenance problems. (auth)

22306 (BNL-20212) PARTICLE IDENTIFICATION BY PROCESSING OF SIGNALS FROM MULTIPLE DETECTORS. Gatti, E.; Radeka, V.; Rosenblum, M. (Brookhaven National Lab., Upton, N. Y. (USA)). May 1975. 16p. (CONF-750521-2). Dep. NTIS $4.00.

From ISPRA symposium; Stresa, Italy (20 May 1975).

It has been shown that for particle identification it is convenient to develop instrumentation based on coding the output of the detectors according to the ratio of probabilities that a particular signal is given by the two kinds of particles considered. Particular emphasis is given to uncorrelated responses of each detector of a set, but the case of correlated responses leads to obvious extensions of the ideas presented. (auth)

22307 (BNWL-SA-5299) RADON COMPENSATION FOR ALPHA AIR MONITORING SYSTEMS. Fleming, D. M.; Rising, F. L.; Zuerner, L. V. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 18p. (CONF-750707-5). Dep. NTIS $4.00.

From annual meeting of the Health Physics Society; Buffalo, New York, USA (13 Jul 1975).

Continuous alpha air monitors, employing solid state detectors and single channel analyzers, for the detection of alpha particles of a specific energy have been available commercially for several years. The single channel pulse height analyzers provide good sensitivity to the isotope of interest and reject much of the unwanted activity from other isotopes such as naturally occurring radon and daughters. A small percentage of the radon daughters are degraded in energy by the air between the collecting filter and the diode to the extent that they coincide with energy of the isotope being measured and are counted as unwanted background. When ^{239}Pu is the isotope being measured the activity in the Pu channel resulting from radon is typically 2 percent of the total radon background. The majority of this unwanted background results from the degradation of the 6.0 MeV ^{218}Po (RaA) peak. This background is sufficient to cause instrument alarms during periods of radon activity. In attempts to reduce the frequency of false alarms, background subtraction circuits have been added as standard equipment to most of the alpha air monitors available on the market for the past several years. A method for calibrating these background subtraction circuits using a radon generator is described. (WHK)

22308 (EGG-565-118) MEASUREMENT OF DETECTOR NEUTRON ENERGY RESPONSE USING TIME-OF-FLIGHT TECHNIQUES. Janee, H. S. (EG and G, Inc., Goleta, Calif. (USA)). Sep 1973. Contract AT(26-1)-565. 64p. Dep. NTIS $5.45.

The feasibility of using time-of-flight techniques at the EG and G/AEC linear accelerator for measuring the neutron response of relatively sensitive detectors over the energy range 0.5 to 14 MeV has been demonstrated. The measurement technique is described in detail as are the results of neutron spectrum measurements from beryllium and uranium photoneutron targets. The sensitivity of a fluor photomultiplier LASL detector with a 2- by 1-inch NE-111 scintillator was determined with the two targets, and agreement in the region of overlap was very good. (auth)

22309 (EGG-1183-2125) APPROXIMATE ENERGY SENSITIVITY OF LASL DIELECTRIC RADIATION DETECTOR. Anderson, W. C.; Hocker, L. P. (EG and G, Inc., Santa Barbara, Calif. (USA)). Feb 1967. 29p. Dep. NTIS $4.50.

Measurements of the responses of a series of the Los Alamos Scientific Laboratory's ON-type dielectric radiation detectors to various linear accelerator bremsstrahlung distributions are described. The three ON detectors, which were built and calibrated at EG&G's Las Vegas division, are small Compton-type units that are filled with dielectric material, usually polybutene oil, or sometimes with teflon. A technique was developed to approximate the detector energy sensitivity from the bremsstrahlung responses. This method yielded the energy response from 100 keV to 20 MeV, which compared favorably at 1.25 MeV with the standard ^{60}Co calibration values supplied with the detectors. A simple experiment to measure the quantum efficiency of polybutene 32X oil is also described, and some preliminary results are given. (auth)

22310 (EGG-1183-2238) TIME RESPONSE MEASUREMENTS OF LASL DIAGNOSTIC DETECTORS. Hocker, L. P. (EG and G, Inc., Santa Barbara, Calif. (USA)). Jul 1970. 55p. Dep. NTIS $5.75.

The measurement and data analysis techniques developed under the Los Alamos Scientific Laboratory's detector improvement program were used to characterize the time and frequency response of selected LASL Compton, fluor-photodiode (NPD), and fluor-photomultiplier (NPM) diagnostic detectors. Data acquisition procedures and analysis methods presently in use are summarized, and detector time and frequency data obtained using the EG and G/AEC electron linear accelerator fast pulse (approximately 50 psec FWHM) as the incident radiation driving function are presented. (auth)

22311 (EGG-1183-2316) SPECTRAL CHARACTERIZATION OF CHERENKOV LIGHT IN LOW-LOSS FIBERS. Franks, L. A.; Nelson, M. A.; Davies, T. J. (EG and G, Inc., Santa Barbara, Calif. (USA)). May 1975. 9p. (CONF-750901-1). Dep. NTIS $4.00.

From international conference on optical fibre communications; London, UK (19 Sep 1975).

Cherenkov light generated in low-loss fibers by relativistic charged particles is potentially useful in radiation monitoring applications where wide bandwidth measurements are required. The characteristically wide spectrum of the light is a possible bandwidth limitation because of material dispersion in the guide. Studies made to characterize the spectral content of the Cherenkov light transmitted through up to 500 m of a step index fiber are reported. Changes in the spectrum of transmitted light were found to be generally consistent with published loss curves. The spectrum was found to be independent of the signal between the electron beam and the fiber axis but a strong intensity dependence was found. (auth)

22312 (IRI-131-74-01) INFLUENCE OF DEAD TIME ON THE STOCHASTICS OF PULSE DETECTION SYSTEMS. de Vries, J. W. (Interuniversitair Reactor Instituut, Delft (Netherlands)). May 1974. 47p.

In practice the dynamics of pulse detection systems are not unbound, but confined within certain limits. Especially, the high frequency characteristic is of importance in conjunction with the resolution of the system. As a consequence, an upper boundary is imposed upon the number of events the system is capable of processing per unit time interval. If the observed process is of a stochastic nature, always some information concerning the process will be lost. In the limiting case, there will be no information at all and consequentially one is faced with complete uncertainty. This phenomenon manifests itself in increasing the expectations variance of the observed process. The variance of the expectation of the observed pulse frequency on the contrary is decreased. This could create the impression that the measurement is more accurate than actually is the case. This report enters into the merits of these phenomena as they appear with the registration of nuclear processes. However, the method outlined in the sequel is generally applicable to a wide variety of stochastic processes. (NL)

22313 (MLM-2248(OP)) INSTRUMENTATION FOR PHOSWICH DETECTORS. Tomlinson, F. K. (Mound Lab., Miamisburg, Ohio (USA)). 1975. Contract AT-33-1-GEN-53. 13p. Dep. NTIS $4.00.

The operation and performance of phoswich detectors and their associated readout systems are described. (WHK)

22314 (RD/B/N-3234) ASSESSMENT OF METHODS FOR THE DETECTION AND SPATIAL LOCALISATION OF RADIOACTIVE PARTICLES. Darley, P. J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1974. 37p.

Recent progress in the development of methods for the spatial localisation of individual radioactive particles is outlined with particular attention being given to the localisation of β active particles in the respirable size range. One of the techniques described, which employs a scintillation detector coupled to an image intensifier, would appear to have considerable development potential as a rapid routine method for monitoring of radioactive particulates. The new technique of scanning electron microscope autoradiography has however the distinct advantage that it allows valuable additional information on the particle size, composition, activity and energy of β emission to be obtained, and this method has been selected as the preferred route for extending the present single particle analysis capability of the Health Physics Research Section. (auth)

22315 (UCRL-51761) ENVIRONMENTAL TESTS OF MA-106 LIGHT-FLASH EXPERIMENT HARDWARE. Aaron, C. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Feb 1975. Contract W-7405-Eng-48. 15p. Dep. NTIS $4.00.

MA-106 light-flash experiment hardware, which detects and records high-energy ion data, was subjected to temperature, altitude, oxygen atmosphere, pressure, and vibration tests. The MA-106 equipment was designed at the Lawrence Berkeley Laboratory (LBL) and Lawrence Livermore Laboratory (LLL) for the National Aeronautics and Space Administration (NASA). LLL built the hardware to NASA specifications. Both flight systems passed the acceptance test, and the qualification system passed the more severe qualification test; both tests were conducted at LLL to NASA specifications. MA-106 will be used to investigate light flashes which seem to occur within astronaut's eyes during space flight. (auth)

22316 DESIGN OF PARALLEL HOLE GAMMA CAMERA COLLIMATORS. Causer, D. A. (Univ., of Aberdeen, Eng.). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 355-362(Jun 1975).

A method of optimization of parallel hole collimator dimensions is developed. The concept of a resolution index is replaced by that of a maximum object frequency which can be imaged. The collimator system is analyzed using sampling theory in the same way as fiber optic systems have been analyzed. In terms of transfer function theory, the fiber optic bundle is shown to be described by a special case of a more general equation, which describes the performance of parallel hole collimators. (auth)

22317 SOLID-STATE TRACK DETECTORS FOR INTRA-REACTOR MEASUREMENTS. Arinkin, F. M.; Batyrbekov, G. A.; Bekmurzaeva, Z. B. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 74-76(1974). (In Russian).

The chief properties of track detectors based on silicate glass and the process of chemical etching are considered. A method for treating the detectors with a microphotometer is described. (tr-auth)

22318 SCINTILLATION COUNTER, SEGMENTED SHIELD. Olson, R. E.; Thumim, A. D. (to Packard Instrument Co., Inc.). US Patent 3,883,742. 13 May 1975. Filed date 27 Jul 1973. 8p.

A scintillation counter, particularly for counting gamma ray photons, includes a massive lead radiation shield surrounding a sample-receiving zone. The shield is disassembleable into a plurality of segments to allow facile installation and removal of a photomultiplier tube assembly, the segments being so constructed as to prevent straight-line access of external radiation through the shield into radiation-responsive areas. Provisions are made for accurately aligning the photomultiplier tube with respect to one or more sample-transmitting bores extending through the shield to the sample receiving zone. A sample elevator, used in transporting samples into the zone, is designed to provide a maximum gamma-receiving aspect to maximize the gamma detecting efficiency. (auth)

22319 SCINTILLATION COUNTER, MAXIMUM GAMMA ASPECT. Thumim, A. D. (to Packard Instrument Co. Inc.). US Patent 3,883,741. 13 May 1975. Filed date 27 Jul 1973. 8p.

A scintillation counter, particularly for counting gamma ray photons, includes a massive lead radiation shield surrounding a sample-receiving zone. The shield is disassembleable into a plurality of segments to allow facile installation and removal of a photomultiplier tube assembly, the segments being so constructed as to prevent straight-line access of external radiation through the shield into radiation-responsive areas. Provisions are made for accurately aligning the photomultiplier tube with respect to one or more sample-transmitting bores extending through the shield to the sample receiving zone. A sample elevator, used in transporting samples into the zone, is designed to provide a maximum gamma-receiving aspect to maximize the gamma detecting efficiency. (auth)

22320 METHOD OF STABILIZING SINGLE CHANNEL ANALYZERS. Fasching, G. E.; Patton, G. H. (to Secretary of the Interior). (US Patent 3,868,509. 25 Feb 1975. Filed date 5 Dec 1973. 8p.

A method and the apparatus to reduce the drift of single channel analyzers are described. Essentially, this invention employs a time-sharing or multiplexing technique to insure that the outputs from two single channel analyzers (SCAS) maintain the same count ratio regardless of variations in the threshold voltage source or voltage changes, the multiplexing technique is accomplished when a flip flop, actuated by a clock, changes state to switch the output from the individual SCAS before these outputs are sent to a ratio counting scalar. In the particular system embodiment disclosed that illustrates this invention, the sulfur content of coal is determined by subjecting the coal to radiation from a neutron producing source. A photomultiplier and detector system equates the transmitted gamma radiation to an analog voltage signal and sends the same signal, after amplification, to a SCA system that contains the invention. Therein, at least two single channel analyzers scan the analog signal over different parts of a spectral region. The two outputs may then be sent to a digital multiplexer so that the output from the multiplexer contains counts falling within two distinct segments of the region. By dividing the counts from the multiplexer by each other, the percentage of sulfur within the coal sample under observation may be determined. (auth)

22321 GAIN STABILITY OF THE FEEDBACK LINEAR PULSE AMPLIFIERS FOR THE FAST PULSE INPUT. Suhn, B. J. Korean Inst. Electron. Eng.; 11: No. 3, 105-118(1974). (In Korean).

The gain stability of the nuclear pulse linear amplifiers with feedback for such a fast pulse input as the step voltage or the nuclear radiation detector pulse is analysed in detail. The expression is derived which describes the wave-form at the anode circuit of the photomultiplier tube which is a part of the nuclear radiation detector. It is analysed and compared when the feedback amplifier has one and two time-constants. When these fast input pulse voltages are applied to the feedback amplifier, the effects of feedback in linearity and stability of the output voltage appear only after two or three rise-times of the amplifier. And it is proved that in order to reduce this limitation, the rise time of the feedback amplifier should be less than the input pulse width. It is also shown that the above theory can be applied directly to the voltage-shunt feedback amplifier stages designed as the basic amplifier of the linear amplifier, and that the gain stability is more improved for the smaller input impedance of this amplifier stage. (auth)

22322 RELATIVE INFLUENCE OF GEOMETRY AND STATISTICAL FLUCTUATIONS OF ENERGY LOSS ON THE DISTRIBUTION FUNCTION OF ENERGY DEPOSITION BY CHARGED PARTICLES IN PROPORTIONAL COUNTERS. Bailey, N. A.; Steigerwalt, J. E. (Univ. of California, La Jolla, San Diego). Health Phys.; 28: No. 5, 503-509(May 1975).

If the energy loss for a charged particle traversing a fixed pathlength were a single valued function of the parameters governing energy loss by charged particles, then the pathlength distribution through a given volume would completely describe the distribution of energy losses found for particles traversing that volume. This would be true for either parallel or isotropically incident beams. In many instances of interest in microdosimetric measurement, statistical variations of energy losses by individual particles will play a significant role in determining the character of the resultant energy deposition distribution function obtained in a proportional counter. This has been investigated with an approximate analytical method for isotropically incident particle beams having various energies and masses traversing a number of differently shaped volumes, namely, the sphere and cylinders of different height-to-diameter ratios. Corrections for delta ray losses or contributions have not been considered. (auth)

22323 SCANNER FOR THE RECORDING OF RADIOACTIVITY DISTRIBUTION. Seebeck, U. (to Philips Gloeilampenfabrieken NV). Canadian Patent 963,983. 4 Mar 1975. 5p.

In a scintiscanner comprising an upper measuring head and a lower measuring head and associated write heads, the activity distribution measured by the lower measuring head is recorded in the form of a mirror-image if the write heads in the two recording directions are moved in the same direction with respect to each other. However, if the write heads in the one recording direction are displaced opposite to each other, a correct recording is obtained, but it is then very difficult to compare the scintigrams recorded by the measuring heads. The invention describes a simple mechanical device by means of which the write heads can be moved in the same or in the opposite direction with respect to each other. One write head is coupled to a guide member which has portions that move in parallel and antiparallel when the one write head is moved. The second write head is selectively coupled to either the parallel or antiparallel moving portions of the guide member. In one embodiment the guide member is a wire loop passed around spaced apart rollers. In another embodiment, the guide member comprises a pair of toothed racks drivable in opposite directions by an interposed gear. (CA)

22324 EFFICIENCY OF THE REGISTRATION OF GAMMA RADIATION BY A RADIATION UNIT WITHIN THE ENERGY RANGE OF 0.08 TO 1.25 MeV. Batyushin, G. N.; Klyukin, L. P.; Sinel'nikov, D. G. Yadern. Priborostr.; No. 24, 30-39(1974). (In Russian).

A procedure for calculation of the efficiency of the registration of gamma radiation by a radiation unit within the energy range of 0.05 to 3.0 MeV is presented. A number of independent problems is solved: the quantum yield of photoelectrons and Compton electrons from a lead-shielded and an unshielded iron emitter; the quantum yield of photoelectrons and Compton electrons from lead; results of calculation of the passage of secondary electrons through the wall of a vacuum chamber; the upper limit of the coefficient of electron collection; and the share of electrons scattered backward by the central electrode. The registration efficiency within the gamma-quantum energy range of 0.08 to 1.25 MeV was determined experimentally. (JPRS)

22325 PHYSICAL ANALYSIS AND OPTIMIZATION OF IMAGING SYSTEMS IN NUCLEAR MEDICINE WITH APPLICATION TO QUANTITATIVE RADIOCARDIOGRAPHY. Dagan, J. New York; Columbia Univ. (1974). 166p. University Microfilms Order No. 75-7488.

Thesis (Ph. D.).

The present study treats a number of aspects of quantitative radiocardiography, with the purpose of establishing the accuracy, complexity and utility of methods to collect and retrieve data. Measurements on a mechanical heart model and actual patients are interpreted by means of a comparison of results with a phenomenological model developed for use with a computer, to determine the parameters of blood flow through the heart. The parameters of flow and volume actually measured are compared with those obtained from the computer model. A Monte Carlo program was written to study the effects of body scattering, collimator geometry and isotope energy and distance of source to collimator on optimal spatial resolution and efficiency for multihole collimators for gamma cameras. The performance of an actual detector limits the localization capabilities of the system and leads to other compromises. A new collimation system based on determination of the Fresnel transformation of the image is proposed and investigated by computer simulation. Such a system is vastly superior to the conventional multihole collimator in efficiency for a given spatial resolution. The conventional scintillation detector system has such poor localizing capability that no great advantage can be attained for wide field studies and therefore, the use of a new detector, based on a multi-wire proportional counter filled with liquid xenon is proposed. The capabilities of such an imaging system are investigated and their significance to nuclear medicine discussed. (Diss. Abstr. Int., B)

22326 SVETOSOBIRANIE V STSINTILLYATSIONNYKH SCHETCHIKAKH. (Light Collection in Scintillation Counters). Tsirlin, Yu. A. Moscow; Atomizdat (1975). 264p.

Scintillation counters, because of their high sensitivity, resolution capacity, and reliability, have found wide use. During their construction the scintillator and the method of its photomultiplier counting in order to obtain the best use of the scintillation light receive special attention. The present status of understanding of the transmission of light into the scintillator and light guide, two elements of a scintillation counter, is reviewed. Methods for the calculation and simulation of light collection, discussed in the book, make it possible to establish a relationship between the regularities of light collection in the scintillator and the radiometric characteristics of the scintillation counter such as light yield, resolution, and recording efficiency. The possibility of determining the optimum dimensions of the scintillator and the reflection condition at its surface is indicated. (tr-auth)

22327 HIGH PURITY GERMANIUM RADIATION DETECTORS. Skrivankova, M. (Inst. of Nuclear Research, Rez, Czech.). Jad. Energ.; 21: No. 5, 183-186(Mar 1975). (In Russian).

The technology of the preparation of p^+ and n^+ contacts for high purity germanium detectors is described. The ^{57}Co and ^{60}Co spectra are shown which were measured with the detectors prepared. Energy resolutions 0.86 kV for ^{57}Co and 1.8 keV for ^{60}Co have been obtained in best cases. (auth)

22328 HIGH-STABILITY HALIDE GEIGER-MUELLER COUNTERS. Filatov, A. I.; Kondrasheva, E. P.; Chaikovskii, V. G. Instrum. Exp. Tech.; 17: No. 6, 1609-1610(1974). Translated from Prib. Tekh. Eksp.; No. 6, 55-57(1974).

The characteristics are studied of commercial low-voltage halide counters of β and γ radiation of type SBM-19, SBM-20, and SBM-21 that have high current stability and a small sensitivity spread from specimen to specimen. (auth)

22329 CHARACTERISTICS OF PHOSPHATE GLASSES DEVELOPED AS A DIELECTRIC SOLID STATE PARTICLE TRACK DETECTOR. Bhandari, N. (Physical Research Lab., Ahmedabad, India); Kumar, S. Indian J. Pure Appl. Phys.; 21: No. 12, 834-838(Dec 1974).

A synthetic lead phosphate glass containing $Pb_3(PO_4)_2$: 77.4%, $Mn_3(PO_4)_2$: 10% and Fe PO_4: 12.6% has been developed for studying charged-particle tracks. This glass reveals fairly cylindrical tracks so that length of TINTs (tracks in tracks) and TINCLEs (tracks in cleavage) can be precisely measured. Applications of these glasses in various fields are described. In particular, this glass doped with uranium can be used as a neutron monitor and for studying heavy ion reactions. A search for a super-heavy homologue of lead following neutron activation is also described. (auth)

22330 SCINTILLATION CHARACTERISTICS OF THIN-FILM DETECTORS BASED ON CsI(Tl) AS A FUNCTION OF THALLIUM CONTENT IN THE FILM. Vydai, Yu. T.; Tsirlin, Yu. A.; Chaikovskii, E. F. Zh. Prikl. Spektrosk.; 22: No. 2, 344-346 (Feb 1975). (In Russian).

Films of CsI(Tl) were obtained by thermal evaporation in vacuum. The effect of the temperature of the backing on the thallium content in the film was determined. The light yield and amplitude resolution of the film detectors during excitation by alpha (Pu-239) and x ray (Cd-109) radiation were obtained as a function of thallium concentration in the films over a wide range of values from 10^{-4} to 1 wt%. The alpha/gamma ratio in % per 1 keV is given as a function of thallium concentration in the film. (SJR)

22331 FAN-BEAM GAMMA CAMERA. Keyes, W. I. (Aberdeen Univ., Ger.). Phys. Med. Biol.; 20: No. 3, 489-493(May 1975).

Conventional gamma cameras produce a two-dimensional map of a three-dimensional distribution of gamma-emitting material. The collimator in either a rectilinear scanner or the Anger gamma camera limits the angle of acceptance of the gamma rays in two dimensions, locating the direction from whence they originated to produce a meaningful map of the activity distribution. A slit collimator has now been designed so that the angle of acceptance of the γ-rays is limited in one direction only. Each point in the activity distribution is therefore emitting into an appreciable solid angle, and it is anticipated that the sensitivity of such a device should represent an improvement over conventional gamma cameras. Comparison of the images obtained from a liver slice phantom containing 13 μCi of ^{99m}Tc using this fan beam camera and a conventional parallel hole collimator showed that this type of fan beam camera represents a perfectly feasible design. (UK)

22332 PITFALLS IN GAMMA CAMERA FIELD UNIFORMITY CORRECTION. Jansson, L. G.; Parker, R. P. (Royal Marsden Hospital, Sutton, Eng.). Br. J. Radiol.; 48: No. 569, 408-409 (May 1975).

The count rate profiles have been measured along a 1.2 cm wide strip centered on a camera diameter, across disc sources (30.5 cm diameter) of ^{57}Co or ^{99m}Tc at high count rates, simulating clinical investigations (in excess of 5×10^4 counts per second within a 30 per cent window, Searle-Radiographic PHO-Gamma HP camera). There was a change in uniformity when the energy selection settings of the pulse height analyser (PHA) were varied over a wide range, but no significant changes in uniformity were observed between ^{57}Co and ^{99m}Tc providing the PHA was correctly adjusted for the nuclide in question. The profiles across the same camera diameter for the disc source with various energy settings after a uniformity correction based on ^{57}Co with an energy setting of 109 to 138 keV had been applied demonstrated significant differences, particularly in the centre of the field. The PHA for this particular gamma camera can be quickly adjusted to the photopeak of the nuclide in use by means of the Z-pulse monitor oscilloscope, but a test involving five different experienced operators produced values differing over a range of 12 keV for ^{57}Co; the profiles demonstrated that this range would produce significant changes in uniformity. Great care should therefore be taken in setting up analyser windows, and it may be necessary to plot the actual gamma spectrum; different gamma cameras will have different characteristics, and these should be determined in the individual case. Particular care should be taken with automatic energy selection. In addition non-symmetrical window settings will require special tuning of the gamma camera. (UK)

22333 STUDY OF THE DE-EXCITATION OF SCINTILLATORS BY STATISTICAL METHODS. Kilin, S. F.; Kushakevich, Yu. P.; Protasevich, M. Z.; Chernyavskii, A. F. (Lenin Belorussian State Univ., Minsk). Instrum. Exp. Tech.; 17: No. 6, 1620-1622(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 64-66(1974).

An apparatus for measuring the shape of scintillation pulses in the nanosecond and microsecond ranges is described. The apparatus is designed to block part of the analyzed time interval to facilitate the measurement of long scintillation components. The shapes of scintillation pulses for NaI (Tl), anthracene, stilbene, tolan crystals, plastic and liquid scintillators are measured, and the fraction of the long component for each of them is determined. (auth)

22334 USE OF SILICON RESISTOR TO MEASURE THE INTEGRAL FAST-NEUTRON FLUX DENSITY. Patrikeev, L. N.; Podlepetskii, B. I.; Fedchin, V. M. (Moscow Engineering-Physics Inst.). Instrum. Exp. Tech.; 17: No. 6, 1617-1619(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 62-64(1974).

A study has been made of the use of a detector using silicon planar resistors to measure the integral flux density of fast neutrons. The experiments show that such a detector can measure fast-neutron flux densities in the range $10^{12}-10^{16}$ neutrons/cm^2 during radiation tests in a reactor. Theory predicts that this method can be used to measure fast-neutron flux densities in the range $2 \cdot 10^8-10^{21}$ neutrons/cm^2. (auth)

22335 LARGE-VOLUME BF_3 NEUTRON DETECTOR. Vorona, P. N. (Inst. of Nuclear Research, Kiev). Instrum. Exp. Tech.; 17: No. 6, 1614-1616(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 60-62(1974).

The design and fabrication of a multiple-filament BF_3 neutron detector are described. The detector consists of 73 proportional counters in a common gas-filled volume. Each counter is a hexagonal counting cell consisting of 12 aluminum filaments (the cathode) and a tungsten filament at the center of the cell (the anode). The sensitive volume of the detector is $800 \times 400 \times 120$ mm. The working pressure of the $^{10}BF_3$ is 1100 torr. The plateau on the counting characteristic is ~200 V long. (auth)

22336 COMPACT NEUTRON DETECTOR CONSISTING OF A BANK OF PROPORTIONAL ^{3}He COUNTERS. Bemer, B.; Van'kov, A. A.; Grigor'ev, Yu. V.; Dittse, K.; Kepernik, Kh.; Konyushov, A. G. Instrum. Exp. Tech.; 17: No. 6, 1611-1613 (1974).

Translated from Prib. Tekh. Eksp.; No. 6, 57-59(1974).

A neutron detector consisting of a bank of 91 SNM-50 ^{3}He proportional counters is described. The detector has good temporal and spectrometric characteristics. Its dead time is ~1 μsec. The energy resolution of the bank is ~11% at the thermal neutron peak (that for the individual counters is 4-8%). The detection efficiency is ~100% for thermal neutrons and ~5% for an energy of 1 keV. The intrinsic background of the detector does not exceed 0.4 count/sec. The detector is essentially insensitive to γ rays. (auth)

22337 STABILIZATION OF A SCINTILLATION SENSOR OPERATING IN THE COUNTING MODE. Dubovenko, A. S.; Pronkin, N. S.; Rogozhin, O. V.; Khakhalin, V. V. Instrum. Exp. Tech.; 17: No. 6, 1629-1632(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 72-74(1974).

The operating principles of a scintillation sensor (transducer) operating in the counting mode with an automatic stabilization system are described. The error in counting rate at the output of the sensor and their dependence on various destabilizing factors are analyzed. The counting rate is presented as a function of the supply voltage of the photomultiplier in the range ±60°C. (auth)

22338 HIGH-SPEED CIRCUIT OF A COUNTING CHANNEL FOR PARALLEL CONNECTION OF HALIDE GAMMA QUANTUM AND BETA-PARTICLE COUNTERS. Kolesov, B. M.; Ganichev, G. I.; Efimov, V. A.; Shishmolin, A. N.; Ovchinnikov, A. K. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1329-1331 (1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 76-78(1974).

The high-speed circuit of a counting channel based on two GT309G transistors for parallel connection of n halide $\beta + \gamma$ counters is described. The circuit allows realization of a resolving time τ close to the minimum possible value equal to τ_0/n, where τ_0 is the resolving time of an individual counter. A law is presented which relates the recorded N^P and true N pulse counting rates. (auth)

22339 FOUR-CHANNEL SYSTEM FOR STABILIZING A SCINTILLATION GAMMA-SPECTROMETRIC INSTALLATION. Belle, Yu. S.; Volchok, V. P.; Korovin, V. I. (Inst. of Biophysics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1337-1339(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 82-84(1974).

A system is described for stabilizing two gamma detectors with an LP-4050 analyzer, which ensures a stability of 1% for a variation of the transmission coefficient of some path element, including the photoelectron multiplier, by ±20%. Flashes of AL-102B light-emitting diodes are used as a reference. The

system does not introduce any noticeable increase in analyzer dead time or broadening of the photopeaks of the measured spectra. (auth)

22340 LOGARITHMIC CIRCUIT WITH A DIGITAL OUTPUT FOR MEASUREMENTS OF A CHARGE GREATER THAN OR EQUAL TO 10^{-14} C AND FOR DETERMINATION OF ITS SIGN. Butenko, V. D.; Gordeev, Yu. P.; Mel'nikov, V. V.; Savin, B. I.; Yakovlev, B. M. (Moscow State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1385-1387(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 118-120(1974).

A circuit is described containing a charge-sensing amplifier, a logarithmic amplitude-digital converter based on a "ringing" tuned circuit and a logical block for determining the sign of the charge according to the first half-wave of the oscillation in the tuned circuit. The use of a charge-sensing amplifier allowed elimination of the effect of chatter of the contacts of the relay which connects the source of the measured charge to the amplifier input. The range of measurable charges is $0.5 \cdot 10^{-14}$ to 10^{-11}C; the intrinsic amplifier noise is $\leq 1.6 \cdot 10^{-15}$ C in the temperature range from −20 to +55°C. (auth)

22341 DIGITAL MAJORITY COINCIDENCE SYSTEM WITH NUMEROUS INPUTS. Basiladze, S. G.; Gvozdev, V. Ya. (Joint Inst. of Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 17: No. 6, 1638-1640(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 178-180(1974).

There are now many multichannel hodoscope systems using proportional chambers and scintillation counters, and this has given interest to units that determine the number of particles passing simultaneously through the hodoscope plane. Systems of this type have previously employed analog summation, which is possible only when the number of particles is small (the order of the coincidence is low) and when the number of inputs is also small. As the number of inputs increases, it becomes desirable to use digital methods of determining the number of triggered channels in the hodoscope plane. If the order of the coincidence is greater than 4, digital summation is the best of various selection methods. A description is given of a majority-coincidence unit for coincidences of order from 1 to 11 with digital selection and 16 inputs. The decision delay varies from 15 to 50 nsec. Sockers are provided for unlimited expansion of the number of units in order to find the number of particles passing through a hodoscope system. (auth)

22342 CALCULATION OF THE TENSION OF THE WIRES IN PROPORTIONAL COUNTERS. Tel'nov, V. I. (Inst. of Nuclear Physics, Novosibirsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1292-1294(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 46-47(1974).

Formulas are derived for calculating the tensions which ensure stability of the signal wires, and the magnitude of the sag of the high-voltage electrodes as a function of the voltage. (auth)

22343 RECORDING OF NEUTRONS UNDER CONDITIONS OF INTENSE BETA−GAMMA BACKGROUND. Anikolenko, V. A.; Antonov, A. V.; Isakov, A. I.; Perekrestenko, A. D.; Tikhomirov, A. A. (Inst. of Physics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1310-1312(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 60-62(1974).

The electronic circuit of the semiconductor detector for a ^{3}He counter is considered which is used to record ultracold neutrons in the presence of high-intensity $\beta-\gamma$ background. (auth)

22344 SHAPE DISCRIMINATOR FOR PULSES FROM A COMBINED CsI(Tl)−NaI(Tl) SCINTILLATION DETECTOR. Belle, Yu. S.; Korovin, V. I. (Inst. of Biophysics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1313-1316(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 62-65(1974).

The circuit of a shape discriminator for the pulses from a scintillation detector made up of CsI(Tl) plates and a NaI(Tl) crystal is described; the detector is designed for simultaneous recording of bremsstrahlung from incorporated ^{90}Sr in the 15 to 200 keV range and γ radiation in the 0.1 to 3.0 MeV range. The circuit operates according to the "zero-crossing" method and is designed for use in a wide (~ 500) range of input amplitudes. The working temperature range is 20 ± 10°C. (auth)

22345 FISSION FRAGMENT COUNTERS (REVIEW). Gangrskii, Yu. P.; Markov, B. N.; Tsipenyuk, Yu. M. (Inst. of Physics Problems, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1245-1258(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 7-19(1974).

The review considers the physical and construction characteristics, as well as the operating properties, of both the most extensively used fission fragment counters (ionization, scintillation, semiconductor, and secondary-emission) and of the superconducting and diamond detectors that have been developed recently. The fields of application of the counters are considered in detail. (69 references) (auth)

22346 CONCERNING THE MINIMAL THRESHOLDS OF CIRCUITS FOR THE SEPARATION OF NEUTRONS AND GAMMA RAYS. Dulin, V. A. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1299-1301(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 51-53(1974).

The general principles for the separation of neutrons and γ rays by organic scintillators are considered. The minimal statistical allowable thresholds of a series of circuits are calculated. A comparison between computation and experiment is made. (auth)

22347 EFFECT OF RADIATION ON THE LUMINESCENCE OF PLASTIC SCINTILLATORS. Kulinich, Yu. A.; Rukavishnikov, V. G.; Chineikin, M. T. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1302-1304(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 54-55(1974).

Data are presented which indicate the radiative changes in light yield and in the chararacter of the deexcitation of a plastic scintillator, which are caused by unstable centers. The change in character of the luminescence begins to be manifested at doses that are 10^3 to 10^4 times as small as the changes caused by stable centers. These changes should be taken into account in work with cooled scintillators and in performing measurements in intense beams. A qualitative explanation of these phenomena is given. (auth)

22348 SURVEY OF RADIATION PROTECTION INSTRUMENTS USED IN HUNGARY. Deme, S. (MTA Kosponti Fiziki Kutato Intezete, Budapest). Izotoptechnika.; 18: No. 3, 138-145(Mar 1975). (In Hungarian).

A survey was made of the sensitivity and performance of the radiation protection instruments currently in use in Hungary. The results showed that about half of the instruments should be replaced either because of faulty operation or inadequate sensitivity. The survey also showed that the number of different types of instruments is too large making maintenance difficult. It is recommended that the defective instruments should be replaced; however in the replacement process the number of different types of instruments should be sharply reduced in order to achieve greater standardization and to make maintenance easier. (JSR)

22349 PROPORTIONAL WIRE CHAMBER WITH ELECTRONIC INTEGRATION. Alekseev, A. V.; Borisov, A. A.; Glebov, V. Yu.; Gubrienko, K. I.; Kuznetsov, V. S.; Yampol'skii, I. R. (Inst. of High-Energy Physics, Serpukhov, USSR). Instrum. Exp. Tech.; 17: No. 6, 1599-1601(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 47-49(1974).

A proportional wire chamber is described which is used for determining the profile of secondary particle beams. Analog information from each wire is stored in an input capacitor, amplified by a two-stage high input-impedance amplifier, and applied in succession to a storage oscilloscope through linear gates controlled by a monostable multivibrator. (auth)

22350 GEOMETRY FACTOR FOR A PLANE DETECTOR AND VOLUME CYLINDRICAL SOURCE. Manchuk, V. A.; Zhileikin, Ya. M.; Berezin, B. I. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1284-1285(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 501-502(Dec 1974).

In the radiometry of gases and aerosols, there is a requirement for absolute measurement of the activity of a gas contained in a closed volume. As is well known, the analysis of the results of such measurements is connected with the use of a number of parameters characterizing the radiometric setup; the geometry factor of the measuring system is one of them. However, while the geometry factor for a plane source (specifically for a parallel arrangement of detector and source) is known, the problem of the geometry factor for a system with a volume source still remains unsolved judging from published data. A method is described and results presented for a calculation of the geometry factor for a system made up of a volume cylindrical source and a plane detector in the shape of a disc located on an end of the cylinder and coaxial with it. (WHK)

22351 MEASURING EQUIPMENT FOR THE DETERMINATION OF NATURAL ^{32}Si ACTIVITIES. Kater, R.; Froehlich, K. Isotopenpraxis; 11: No. 3, 103-105(Mar 1975). (In German).

The activity of the daughter nuclide ^{32}P is measured in order to determine the natural ^{32}Si contents in atmospheric and ground waters. Since activity levels in most cases range below 0.3 decays of ^{32}Si (per min and m^3 of water), apart from the processing of large water volumes, a sensitive radiation detector having a very low background is needed. A set of radiation metering equipment is described, which is provided with commercial semiconductors

and, its counting efficiency being 46% for ^{32}P and its background amounting to 7 pulses per hour, renders possible measurement of very low ^{32}P activities with high accuracy. Two examples of metering are presented to show the efficiency of the equipment. (auth)

22352 EFFECT OF ELECTRO-PHYSICAL PARAMETERS OF THE SILICON SURFACE ON THE PROPERTIES OF SURFACE-BARRIER DETECTORS. Barabash, L. I.; Litovchenko, P. G.; Lastovetskii, V. F.; Chala, S. V. (Inst. of Nuclear Studies, Kiev). Poluprov. Tekh. Mikroelektron.; 19: 60-69(1975). (In Russian).

The effect of corrosion on such properties of silicon surface as heterogeneity, surface potential kinetics, density of "fast" surface electron state, and time changes in oxide film thickness was studied. It was shown that optimum processing of the surface can improve the spectrometric properties of the surface barrier of nuclear radiation detectors. (tr-auth)

22353 USE OF STRETCHED-CROSSING TIMING IN NEUTRON–GAMMA PULSE SHAPE DISCRIMINATION. Sztaricskai, T. (Kossuth Lajos Tudomanyegyetem, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozl.; 17: No. 1, 31-36(1975). (In Hungarian).

A PSD system based on pulse width analysis was developed, using the stretched-crossing timing method. The neutron discrimination level is > 150 keV. The application of leading edge timing does not give a very wide dynamic range. The use of NE 905 and ^{6}LiI(Eu) for PSD was new. The best PSD properties in this system were shown by the octodeuterised naphthalene. (auth)

22354 REMOTE SENSING OF PLUTONIUM BY THE LOW-ENERGY SCATTERED FLUX. Profio, A. E. (Univ. of California, Santa Barbara); Huth, G. C. Nucl. Technol.; 26: No. 3, 340-351(Jul 1975).

Detection of plutonium and other gamma-ray emitters at penetrations of a few mean-free-paths in air or earth is improved by counting the scattered component below approximately 100 keV in a low-back-ground detector such as 5-mm-thick lithium-drifted germanium. The uncollided and scattered fluxes are calculated for point 1-MeV, 130- and 60-keV, and ^{239}Pu spectrum sources in effectively infinite air with discrete-ordinates, Monte Carlo, and analytical methods. Count rates were estimated by summing the efficiency-weighted fluxes and multiplying by the area. Minimum detectable activities were evaluated from a signal count equal to three times the standard deviation in the background count, obtained from experimental data. The performance of the low-background Ge(Li) detector, per cm^2 of detector area, is shown to be considerably better than that for a thick sodium-iodide scintillation detector traditionally used for remote sensing of plutonium and other gamma-ray sources. A calculation for a 5-cm-radius plutonium ball embedded in earth shows that total-flux counting in a thin low-background detector provides good sensitivity while traditional photopeak counting of uncollided photons is impossible. (auth)

Radiation Dosimeters

Refer also to abstract 23519.

22355 (BNL-20100) CALIBRATION OF THE EXPERIMENTAL BND PERSONNEL NEUTRON DOSIMETER FOR GENERAL USE. Distenfeld, C. (Brookhaven National Lab., Upton, N. Y. (USA)). 1972. 25p. (CONF-750551-1). Dep. NTIS $4.25.

From fifth ERDA workshop on personnel neutron dosimetry; Washington, District of Columbia, USA (6 May 1975).

The experimental Brookhaven neutron dosimeter, BND, is a composite damage track and thermoluminescent detector. Thorium fission is used to respond to greater than 1 MeV and high sensitivity TLD 600 and 700 ribbons respond to softer neutrons. Previous experimental work at the Alternating Gradient Synchrotron, AGS, a 33 GeV proton accelerator, utilized the energy dependence of the ratio of thermoluminescent to Thorium response, softness. Softness variation was related to a correction factor used to adjust a TLD response to properly account for the dose equivalent. Calibration data for the BND for soft reactor spectra are presented. (WHK)

22356 (CEA-R-4683) SENSITIVITY OF VARIOUS THERMOLUMINESCENT, PHOTOLUMINESCENT AND PHOTOGRAPHIC DETECTORS TO NEUTRONS EMITTED BY A Pu–Be SOURCE. Spurny, F.; Marsault, R.; Medioni, R.; Portal, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Jul 1975. 29p. (In French). Dep. NTIS (US Sales Only) $4.50.

A series of experiments were conducted in order to determine the sensitivity of radiothermoluminescent detectors to fast neutrons. Experiments bearing on the determination of the sensitivity to neutrons emitted by a Pu-Be source are related here. The characteristics of the radiation field emitted by the source and especially of the γ-field are analyzed. The measuring procedures are described and a study is made of the best experimental procedures liable to eliminate or decrease the effect of external factors. The results are analyzed. (auth)

22357 (COO-323-34) SPECIAL PROBLEMS IN NUCLEAR INSTRUMENTATION. Progress Report, 1 June 1974--31 May 1975. Spokas, J. J. (Illinois Benedictine Coll., Lisle (USA). Physical Sciences Lab.). 1975. Contract E(11-1)323. 19p. Dep. NTIS $4.00.

The angular dependence of the sensitivity has been studied in 0.5 cc thimble type ionization chambers. A significant variability in neutron sensitivity has been discovered in magnesium chambers. Previous conducting plastic mixtures were reviewed with regard to composition and equivalence. Results are presented and discussed. (WHK)

22358 (FRNC-TH-533) DOSIMETRIC STUDY OF A BEAM OF 25-MV X RAYS EMITTED BY A LINEAR ACCELERATOR FOR ITS APPLICATION TO MEDICINE AND BIOLOGY. Marinello, G. (Toulouse-3 Univ., 31 (France)). 1974. 100p. (In French). Dep. NTIS (US Sales Only) $8.00.

Thesis.

A complete dosimetric study was made for the 25 MV x-ray beam emitted by a linear accelerator of the Sagittaire type. After a brief description of the apparatus used, the principles of the dosimetric methods used were described in detail. All the studies were made using polystyrene and plexiglas. The distribution of the absorbed dose in an irradiated medium by a beam of high energy photons depends both on the variation of the dose output in the beam and the elementary interactions of the photons with the medium. Therefore a detailed study was first made of the beam in air before studying the progressive increase of the dose at the entry to the tissue-equivalent medium, the depth yield on the beam axis, and the isodose curves as a function of the geometric irradiation conditions. The results obtained make it possible to establish a treatment plan for patients and to evaluate the dose delivered to the tumor with great precision. (JSR)

22359 (RISO-M-1787) RESPONSE OF THERMOLUMINESCENCE DOSIMETERS TO MONOENERGETIC PHOTONS OF ENERGIES BETWEEN 15 keV AND 100 keV. Christensen, P.; Boetter-Jensen, L.; Majborn, B. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jun 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

Experimental photon energy response curves using monochromatic x-ray sources for the exposures are presented for standard thermoluminescent dosimeters applied in the personnel and environmental monitoring programmes at Risoe. The investigation included dosimeters of LiF, $Li_2B_4O_7$:Mn, CaF_2:Mn, CaF_2:Dy and $CaSO_4$:Dy. Good agreement between experimental and calculated data has been obtained for small-size (30 milligrams) dosimeters whereas dosimeters of greater masses showed an increase in the response which is ascribed to scattered radiation. Compared to data earlier obtained from the personnel badge using filtered x-rays a decrease of the response of the order of 10 to 20 percent was observed for exposures from monochromatic x-rays. The increase of the response of the personnel badge when attached to a phantom and due to scattering from the phantom material amounted to up to 50 percent. (auth)

22360 (UCRL-76944) LLL SPECIAL PROJECTS DIVISION RESEARCH IN NEUTRON MEASUREMENTS TECHNIQUES. Griffith, R. V.; Slaughter, D. R.; Crites, T. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jun 1975. 9p. (CONF-750551-1). Dep. NTIS $4.00.

From 5th ERDA workshop on personnel neutron dosimetry; Washington, District of Columbia, USA (6 May 1975).

The neutron measurement research is primarily in support of the applied health physics program at LLL, and currently the emphasis is on neutron spectrometry and personnel neutron dosimetry. The spectrometry work involves development of high resolution detectors such as NE 213 scintillators, ^{6}Li scintillators, ^{3}He proportional counters, and hydrogen proportional counters and multisphere moderator detectors. The personnel dosimetry research involve development of an albedo dosimeter and a fast neutron dosimeter to augment albedo dosimeter data. (WHK)

22361 PHOSPHOR FOR THERMOLUMINESCENT TYPE RADIATION DOSIMETER. Nada, N.; Yamashita, T. (to Matsushita Electric Industrial Co., Ltd.). US Patent 3,883,748. 13 May 1975. Priority date 29 Jun 1967, Japan. 6p.

This has the accumulation effect of radiation energy and is mainly used as the element for thermoluminescent type radiation

dosimeters. It has as the principal constitutent a phosphor consisting of calcium sulfate as the principal constituent and other impurity elements such as dysprosium, thulium and the like. It is more sensitive by the order of 1 to 2 or more figures than the conventional ones and is excellent in the retention of absorbed radiation energy. (auth)

22362 PASSIVE DOSIMETRY MEASUREMENTS ON BOARD THE SKYLAB II MISSION. Wailly, L. F.; Schneider, M. F.; Janni, J. F.; Grimm, A. D.; Ainsworth, G. C. (Air Force Academy, Colorado Springs, CO). Aerosp. Med.; 45: 1237-1243(Nov 1974).

Passive dosimeter packages were located at five stations in Skylab II and consisted of arrays of thermoluminescent devices, ionization chambers, and activation foils. Film emulsions and heavy particle track detectors are also included. There was a relative lack of appreciable softer/bremsstrahlung X rays within the Command Module. The results indicate no measurable neutron contribution over the range .025 eV to 10 keV. It was confirmed that there is no dose buildup with increased shielding. Radiation levels recorded consisted of about 90% penetrating protons. The earth's magnetic field provides sufficient shielding for astronaut safety from solar flare activity in the Skylab orbit. Limited orbital time is the only solution for higher altitude manned operations. The Skylab II dose levels exceeded those on Gemini IV, due to higher altitude and inclination. Doses on Skylab III, while above the 100 mrad/week allowable for routine earth-based operation, will not produce measurable clinical damage. (Int. Aerosp. Abstr.)

22363 RESPONSE OF NTA FILM TO NEUTRONS AND THE PHANTOM EFFECT. Chou, Y. Y. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Nucl. Sci. J. (Taiwan); 12: No. 1, 48-53(Mar 1975). (In Chinese).

Calibration of Kodak NTA (nuclear track) film is described. NTA films worn on phantoms were exposed to an Am–Be standard source and Taiwan Research Reactor Thru Tube neutron beam, responses of which are presented in terms of number of proton tracks per square centimeter per mrem. The detectable limit of dose equivalent of NTA films, related to the number of scanning field, is statistically discussed, and the phantom effect is also studied. (auth)

22364 USE OF SEMICONDUCTOR DETECTORS IN RADIATION DOSIMETERS. Andreev, P. N.; Filov, R. A. (Inst. of Biophysics, Moscow). Instrum. Exp. Tech.; 17: No. 6, 1602-1603(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 50-51(1974).

On the basis of experimental pulse-amplitude spectra obtained from a series of semiconducting detectors, the effect of instabilities in the discrimination threshold on the pulse count rate is estimated. It is shown that a 1 to 2% instability of the threshold may lead to changes of over 20% in the counting rate. (auth)

22365 SILICON GAMMA-RADIATION DOSIMETER WITH AN INCREASED RADIATION DURABILITY. Galushka, A. P.; Dubovoi, V. K. (Inst. of Nuclear Research, Kiev). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1305-1306(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 56-57(1974).

The characteristics of a dosimeter for γ radiation from ^{60}Co which is fabricated from a Si single crystal having a $p^+ - p$ junction that develops during the process of growing the single crystal are presented. It is shown that such a dosimeter does not change its readings up to exposure to a dose of 10^8 R. (auth)

22366 STUDIES OF CALCIUM SULFATE ACTIVATED BY DYSPROSIUM OR THULIUM FOR ENVIRONMENTAL MONITORING. Hsu, P. C.; Chen, M. N. (National Tsing-Hua Univ., Hsinchu, Taiwan). Nucl. Sci. J. (Taiwan); 12: No. 1, 29-41 (Mar 1975).

The ultimate operating conditions of Teledyne Isotopes 7100 for $CaSO_4$:Dy and $CaSO_4$:Tm phosphors were obtained and the stability of the instrument was also carefully examined. Flushing with nitrogen at a flow rate of 6 to 8 SCFH can eliminate the noise signal from the bare heating element. The annealing condition of 400°C for 1 h or 250°C for 2 h is appropriately suitable for these phosphors. The buildup of spurious thermoluminescence or the fading of stored energy can be significantly influenced by the storage conditions of the phosphor such as lead shielding, temperature, visible light, and vibration. The details are graphically presented. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstract 23032.

22367 (ANL-Trans-985) MEASURING SYSTEM FOR SPECTROSCOPIC INVESTIGATIONS OF NUCLEI FAR FROM THE beta-STABILITY LINE. Andert, K. (Joint Inst. for Nuclear Research, Dubna (USSR)). Jul 1975. Translation of JINR-P6-8564. 22p. Dep. NTIS $4.25.

The construction principles and characteristics are given for a number of spectrometers intended for measurements of gamma-, beta- and e^--radiation arising from the decay of short-lived isotopes produced using the synchrocyclotron. Semiconductor and scintillation detectors are used to detect the radiation. The spectra are measured both in one-dimensional and in multidimensional modes. The developed system of programs allows rapid preliminary data processing and optimization of the experimental setup on-line with a small computer. (6 figures, 3 tables) (auth)

22368 (CONF-750319-3) STABLE ISOTOPE RATIOMETER-MULTIPLE ION DETECTOR (SIRMID) UNIT FOR QUANTITATIVE AND QUALITATIVE STABLE ISOTOPE STUDIES BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY. Klein, P. D.; Haumann, J. R.; Hachey, D. L. (Argonne National Lab., Ill. (USA)). 12 Mar 1975. Contract W-31-109-Eng-38. 24p. Dep. NTIS $4.25.

From seventh annual symposium on advanced analytical concepts for the clinical laboratory; Oak Ridge, Tennessee, USA (13 Mar 1975).

A stable isotope ratiometer-multiple ion detector (SIRMID) unit which can drive existing gas chromatograph-quadrupole or magnetic sector mass spectrometers to monitor up to six ions in turn is described. Each of the three pairs of ions can be selected for quantitation; thus three different or successive components can be analyzed in a single GC run. A background subtraction option permits the ion intensity in the absence of sample to be subtracted automatically during sample measurement. Displays of accumulated counts and isotope ratio are updated twice per second during the measurement and can be printed out at its conclusion. All six ions can be monitored in the analog mode by parallel outputs to a multipen recorder. Experience gained in the construction of this prototype indicates that SIRMID units could be commercially available for $10K, or about ⅓rd to ¼th of the cost of even an inexpensive computer system. (auth)

22369 (EGG-1183-2239) TIME RESPONSE, LINEARITY, AND GAIN OF 250-MICRON SILICON SOLID-STATE DETECTORS. Pigg, J. L.; John, W.; Janee, H. S.; Hocker, L. P. (EG and G, Inc., Santa Barbara, Calif. (USA)). Jun 1970. Contract AT-(29-1)-1183. 105p. Dep. NTIS $8.25.

Experiments are described in which the time response, linearity, and gain were determined for the 250-micron silicon solid-state detectors used in a solid-state magnetic gamma-ray spectrometer. Time-response measurements performed at the EG and G/AEC linear accelerator (linac) determined detector impulse response, step response, frequency-domain amplitude, and phase as a function of frequency. Linearity measurements performed with the linac determined detector current and charge linearity at bias levels up to 500 V. Gain measurements made in the counting mode at the NBS Dynamitron (0.25 to 1.0 MeV) and Van de Graaff (2.0 to 4.0 MeV) accelerators determined gain as a function of incident electron energy. (auth)

22370 (GSI-73-3, pp 119-130) STATUS OF THE MUNICH Q3D PROJECT. Glaessel, P.; Huenges, E.; Kreuzer, H.; Loeffler, M.; Vonach, H. (Technische Univ., Munich). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

The design and first experimental results obtained with the Munich Q3D spectrograph are reported. The ion-optical properties and the characteristics of the position-sensitive multiwire proportional chamber are described. The resolving capacity of the spectrograph was determined from elastic scattering measurements of protons on ^{27}Al, ^{59}Co, natural Ag, ^{103}Rh, and ^{209}Bi and from (d,p) reactions on ^{104}Ru. The corrections that must be made to the measurements in order to obtain good results are discussed. (JSR)

22371 (IS-3636) PEAKFIND: A FORTRAN PROGRAM FOR LOCATING AND FITTING PEAKS IN SEMICONDUCTOR DETECTOR SPECTRA. Schick, W. C. Jr. (Ames Lab., Iowa (USA)). Jun 1975. Contract W-7405-eng-82. 92p. Dep. NTIS $7.75.

A FORTRAN program is described which locates peaks in semiconductor detector spectra and then fits a skewed-Gaussian line shape to certain of these peaks to determine centroids, areas, and peak shape parameters. The user may adjust the strictness of criteria used in the peak location procedure to permit the identification of virtually anything that might possibly be a peak, or he may specify that only well-defined peaks are to be found. An estimate is made of the centroid, energy, and intensity (corrected for the energy dependence of the detector efficiency) for each peak found. Fitting is then performed only where the estimated peak intensity exceeds a lower limit specified by the user. Al-

ternatively, the user may specify which specific peaks he wishes to have fitted. The nonlinear least-squares fitting method is a modification of the procedure used in the companion program SKEWGAUS. PEAKFIND normally requires the user to supply only four input data cards for the analysis of a whole multichannel analyzer spectrum, and if default options are chosen for most parameters these cards will be largely blank. (auth)

22372 (LBL-3671) ACCURATE MEASUREMENT OF NOISE PARAMETERS IN ULTRA-LOW NOISE OPTO-FEEDBACK SPECTROMETER SYSTEMS. Llacer, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1975. Contract W-7405-ENG-48. 34p. (CONF-750521-4). Dep. NTIS $4.75.

From ISPRA symposium; Stresa, Italy (20 May 1975).

The accurate measurement of the basic noise parameters of ultra-low noise spectrometer systems has been developed in the frequency domain by spectrum analysis. This method overcomes some of the difficulties experienced in using conventional techniques. An analytic and experimental comparison between "time" and frequency domain techniques is carried out and the use of the latter as a method to develop extremely low-noise detector and FET packages is demonstrated. The origin of the remaining noise in high quality systems is traced to surface and gate junction generation through traps in the FET. (auth)

22373 (NP-20512) DETERMINATION OF ABSOLUTE ACTIVITY BY THE $4\pi\beta$-γ COINCIDENCE METHOD. Silva, A. J. U. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Cienciaa). 1975. 133p. (In Spanish). Dep. NTIS (US Sales Only) $9.75.

Thesis.

As part of a program to produce secondary standards a $4\pi\beta$-γ coincidence system is mounted using a "Pill Box" detector as a beta detector and a 3" × 3" sodium iodide crystal as a gamma detector. Corrections to the measured counting rates are applied. The system was tested with four standards from the "Bureau International Des Poids Et Measures"-(BIPM) and agreement was obtained within 0.5%. (auth)

22374 (RD/B/N-3309) NEW APPROACH TO ELECTRON SPECTROSCOPY IN REACTOR ENVIRONMENTS. Woollam, P. B. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 43p. Dep. NTIS (US Sales Only) $5.25.

A new approach to electron spectroscopy in reactor environments has been considered with the aim of enabling in-situ measurements to be made in the presence of high gamma fluxes. A computer technique to analyze the resultant spectra has been developed and used to study some hypothetical data. Magnetic techniques, telescope techniques, and pulse rise-time techniques are studied. (auth)

22375 CHARACTERISTICS OF THE 180 DEG BACKSCATTERING TROCHOIDAL SPECTROMETER. Roy, D.; Burrow, P. D. (Laval Univ., Quebec City, Can.). J. Phys., E. (London); 8: No. 4, 273-276(Apr 1975).

The characteristics of the 180° backscattering spectrometer are investigated by calculation of the energy distribution of the electrons whose trajectories pass through the spectrometer. This work is an extension of previous calculations on the trochoidal electron monochromator on which the backscattering spectrometer is based. A comparison between certain of the predicted characteristics and those determined by experiment is made. (auth)

22376 THREE- AND FOUR-CRYSTAL X-RAY SPECTROMETERS. Nikiforov, I. Ya. (Rostov Univ., Rostov-on-Don, USSR); Zakharov, I. G.; Hrdy, J. Czech. J. Phys.; 25: No. 7, 723-731 (1975).

The resolution was studied of the following types of x-ray spectrometers: Three-crystal spectrometer with all crystals in antiparallel position, three-crystal spectrometer with first two crystals in quasiparallel position (i.e., these crystals are set into the parallel position and then slightly misaligned) and four-crystal spectrometer with two pairs of quasiparallel crystals. The shape and width of smearing function were calculated and compared with the calculations for a double-crystal spectrometer. (auth)

22377 RADIATION SPECTROMETER FOR MEASURING LOW CONTENT OF INCORPORATED ^{90}Sr. Belle, Yu. S.; Kovtun, A. N.; Kozheurov, V. I.; Kozlovskaya, L. A.; Korovin, V. I.; Lebedev, O. V.; Panteleev, L. I.; Zlobin, L. I. Med. Radiol.; 20: No. 6, 52-58(Jun 1975). (In Russian).

A radiation spectrometer is described and its design is substantiated. The design includes four combined detectors crystal NaI (Tl) in combination with a plate CsI (Tl) which in the operating mode of longitudinal scanning of the patient in a low-protection chamber makes it possible with high sensitivity and accuracy to make a simultaneous measurement of incorporated γ-emitter and the content of ^{90}Sr in the organism by its bremsstrahlung radiation. Measurement limits with the time of measurement limits with the time of measurement of 40 min comprise for ^{137}Cs, ^{90}Sr, and potassium correspondingly 0.7 nCi, 8.2 Cl, and 6.5 g. (auth)

22378 METHOD OF, AND APPARATUS FOR, DETERMINING RADIATION ENERGY DISTRIBUTIONS. Koeman, H. (to U. S. Philips Corp.). US Patent 3,872,287. 18 Mar 1975. Priority date 30 Jul 1971, Netherlands. 14p.

A method and apparatus for measuring the energy distribution of ionizing radiation distinguished by a good signal-to-noise ratio, a fast response and a high degree of accuracy are described. By using switched integrators after a charge-sensitive amplifier connected to the radiation detector, by storing the results of integrations performed in a time T both preceding and following the instant at which a radiation quantum strikes the detector and by adding and subtracting them, a good signal-to-noise ratio is obtained, while the speeds of measuring and data processing are increased, because radiation quanta which are close to each other in time are either still measurable or are eliminated. (auth)

22379 TEMPERATURE RANGE OF EFFICIENT OPERATION OF CADMIUM TELLURIDE GAMMA DETECTORS. Rodionov, Yu. F.; Kalugina, L. I. Instrum. Exp. Tech.; 17: No. 6, 1607-1608(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 54-55(1974).

The temperature dependence of the spectrometric characteristics of diffusion-type CdTe detectors of γ radiation is studied between -170 and +100°C. The resolving power varies by no more than a factor of two between -140 and +50°C, amounting to 5 to 14 keV for various specimens (E_γ = 59.6 keV). The efficiency of carrier collection remains constant at around 80%. Both these parameters worsen below -150 and above 60°C. The efficiency of recording γ radiation is approximately constant between -150 and +80°C. (auth)

22380 SPECTROMETRY OF ALPHA PARTICLES USING SURFACE-BARRIER DETECTORS AT LOW TEMPERATURES. Kushniruk, V. F.; Rykhlyuk, A. V.; Kharitonov, Yu. P. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 17: No. 6, 1604-1606(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 51-53(1974).

The effect of temperature on the spectrometric properties of n-type silicon surface-barrier detectors is studied. For recording α particles with energies of several MeV the optimum temperature lies between -30 and -50°C. The improvement in resolving power is largely due to the reduction in the reverse current of the detector. Anomalies occur in the temperature dependence of the resolving power, apparently as a result of the capture of carriers at trapping centers, with subsequent ejection into the conduction or valence band as the temperature rises. (auth)

22381 COUNTER PLATEAU FOR NaI(Tl), CsI(Na), AND CsI(Tl) SINGLE CRYSTAL DETECTORS IN MIXED FIELDS. Chernikov, V. V.; Sulyga, V. A.; Tsirlin, Yu. A. (All-Union Scientific-Research Inst. of Single Crystals, Kharkov). Instrum. Exp. Tech.; 17: No. 6, 1626-1628(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 69-71(1974).

The possibility of pulse-height discrimination of the background from β-decay products produced by slow neutron irradiation of detector materials based on NaI(Tl), CsI(Na), and CsI(Tl) single crystals is discussed. A multistep counter plateau in the counter characteristics of detectors on irradiation by an external ^{57}Co γ-ray source and an internal source from the β decay of ^{128}I and ^{24}Na is described. (auth)

22382 DEPENDENCE OF THE SPECTROMETRIC PARAMETERS OF SCINTILLATION DETECTORS ON THE IRRADIATION GEOMETRY. Sobornov, O. P.; Shcheglov, O. P. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Instrum. Exp. Tech.; 17: No. 6, 1623-1625(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 67-69(1974).

The parameters of scintillation γ detectors are compared and analyzed. The parameters are determined using standard methods of measurement (using a point γ source) and the extended γ source simulating the isotropic irradiation conditions in which detectors are used. (auth)

22383 PROPERTIES OF A SCINTILLATION RESONANCE DETECTOR FOR MOESSBAUER INVESTIGATIONS. Kaipov, D. K.; Orazbaev, T. A.; Galyutina, E. F.; Sergeeva, L. S. (Kazakh State Univ., Alma-Ata, USSR). Instrum. Exp. Tech.; 17: No. 6, 1629-1632(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 75-76(1974).

A scintillation resonance detector for Moessbauer investigations involving the ^{119}Sn 23.8 keV transition is constructed and studied.

The experimentally observed effects depend on the thickness of the scintillator and its SnO_2 content; reasons for this effect are presented. (auth)

22384 MULTISPHERE SPECTROMETER WITH A SEMICONDUCTOR THERMAL-NEUTRON DETECTOR. Semenov, V. P.; Trykov, L. A.; Fadeev, Yu. V. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1285-1288(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 40-43(1974).

A multisphere spectrometer with a semiconductor thermal-neutron detector of the DTN-1 type is described. The electronic circuit of the instrument and its principal characteristics are presented. (auth)

22385 LAMINAR SCINTILLATORS FOR FAST-NEUTRON SPECTROMETRY. Burymov, E. M.; Orlova, N. V.; Teplov, I. B. (Moscow State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1295-1298(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 48-51(1974).

The shape of the spectra and the dependence of the spectrometric characteristics (resolving power, efficiency, peak-to-valley ratio) of laminar organic scintillators on the thickness of the plates are calculated for measurements of neutron energy. Conventional (containing the light hydrogen isotope) and deuterized scintillators are considered. The calculation is carried out with allowance for the amplitude scatter which develops during the recording of charged particles by a scintillation spectrometer. It is shown that the advantages that develop as a result of the use of thin scintillators increase as the quality of the crystals themselves improves. (auth)

22386 PULSE SYSTEM FOR ALPHA PARTICLE DETECTION WITH A MAGNETIC SPECTROMETER. Rodionov, Yu. F.; Shatinskii, V. M.; Nikitin, B. A. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1288-1289(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 504(Dec 1974).

To simplify the procedures for studying radiation spectra from alpha sources with a large magnetic alpha spectrograph, a system of (electric) pulse recording of α particles was developed. A Si(Li) detector having a working surface of 34 by 15 mm set up in the focal plane of an alpha magnetic spectrometer is described. (WHK)

22387 STUDY OF THE PULSE SHAPE SELECTION METHOD APPLIED TO THE NANOSECOND TIMING WITH COAXIAL Ge(Li) DETECTORS. Szymczyk, W.; Karwowski, H. (Inst. of Nuclear Research Swierk, Poland). Nukleonika; 20: No. 3, 263-272(1975).

A system for measuring nuclear lifetimes with the help of large volume Ge(Li) coaxial detectors has been prepared. The pulse shape selection method has been extensively studied. An improvement of about 40% of prompt curve parameters has been obtained by means of the method. The described system can be used for measuring nuclear levels lifetimes from 4.5 ns for γ-ray energy 100 keV to 0.5 ns for 1.5 MeV. Typical prompt parameters are: fwhm = 2.8 ns, $t_{\frac{1}{2}}$ = 0.38 ns for photopeak 1.33 MeV. (auth)

22388 SPECTRUM SCANNER WITH A STORAGE OSCILLOSCOPE. Bibok, G.; Lakatos, T.; Sulik, B. ATOMKI (At. Kut. Intez.) Kozl.; 17: No. 23-30(1975). (In Hungarian).

The Tektronix 7623 A storage oscilloscope may be used as an X-Y recorder. To complete this oscilloscope, a spectrum scanner with a ramp-controlled single channel analyser and rate-meter was built. With this apparatus the measuring of nuclear modules, made by the electronic department of ATOMKI, will become more quick and exact. (auth)

22389 SIMILARITY CONSIDERATIONS IN TRIAXIAL NEUTRON SPECTROMETER INSTALLATIONS. Quittner, G. (Oesterreichischen Studiengesellschaft fuer Atomenergie, Seibersdorf, Austria). Acta Phys. Austr.; 38: No. 3, 282-280(1973). (In German).

The choice of spectrometer configurations for inelastic neutron scattering giving a good compromise between intensity and resolution depends on a choice of about 15 disposable parameters. The choice of a typical or reference value for the neutron wave number as well as for the angular divergences of collimators and crystals is considered. For simplicity only similar spectrometer configurations are compared. The dependence of counting rate versus the characteristic wave number for fixed momentum resolution is given; under the assumption of a Maxwellian neutron source smaller wave numbers are more advantageous. This applies too when energy resolution is kept constant. These results are of relevance to the choice of Brillouin zones for phonon measurements. (auth)

High Energy Physics Instrumentation

22390 (BNL-20226) 4 pi DETECTOR FOR CORRELATION EXPERIMENTS. Thorndike, A. M. (Brookhaven National Lab., Upton, N. Y. (USA)). 12 Jun 1975. 12p. Dep. NTIS $4.00.

A conceptual design of a 4 pi detector for ISA-BELLE involves a counter hodoscope with 302 elements and an array of proportional wire chambers with 8950 wires. Such a detector could be used for correlation experiments and measurements of total cross section, as has been done by the Pisa-Stony Brook group at the ISR. (auth)

22391 (CEA-CONF-3090) CHARGE AND VELOCITY RESOLUTION OF CHERENKOV COUNTERS IN A BEAM OF ACCELERATED HEAVY NUCLEI. Cantin, M.; Koch, L.; Soutoul, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). 1975. 6p. (CONF-750805-2). Dep. NTIS (US Sales Only) $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

The response of various Cherenkov radiators to oxygen and nitrogen nuclei with energies ranging between 2.1 GeV/n and 300 MeV/n is presented. The velocity and charge resolutions are analyzed in relation to the possible use of these counters for chemical and isotopic analysis of the primary cosmic ray nuclei. (auth)

22392 (COO-1195-344) MATCH: IMPROVING THE EFFICIENCY OF THE DECISION LATTICE SCANNER. Tortora, J. (Illinois Univ., Urbana (USA). Dept. of Physics). 29 May 1975. 10p. (UILU-ENG-75-5502). Dep. NTIS $4.00.

A serious problem was found with the decision lattice scanner (subroutine PSCAN) used by MATCH. PSCAN scans a given two-dimensional decision lattice for solutions of length L. The method used by PSCAN is described first. Then the logic of the program is traced to explain what the problem is: some lattices require grossly excessive time for solution. Specifically, the problem with the former algorithm is that it cannot efficiently handle rows with small numbers of points which are deep into the lattice. A method for circumventing this problem is given. (2 figures) (RWR)

22393 (ITEF-77) SYSTEM WITH A LARGE APERTURE FOR TIME-OF-FLIGHT MEASUREMENTS. Borodin, Yu. A.; Davletshin, R. I.; Kishkurno, V. V.; Kulikov, V. V.; Radkevich, I. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 16p. (In Russian). INIS.

A description is given of a system for measuring the time of flight with a relatively large aperture of 15×25 cm^2. The accuracy attained in measuring the time of flight was ± 0.75 nsec. The system was used in experiments on a 3-meter spectrometer of ITEF for separating protons and deuterons in the region of 1.4 to 2.5 GeV/c. (SJR)

22394 SELF-SIMILARITY IN THE VAPOUR BUBBLE DYNAMICS. Shestakov, V. D.; Tkachev, L. G. (Joint Inst. for Nuclear Research, Dubna). Int. J. Heat Mass Transfer; 18: No. 5, 685-687(May 1975).

The covariance of equations governing the homogeneous vapour bubble dynamics with respect to the transformation of independent variables is stated. It leads to the self-similar time dependence of bubble radius in three cases: (1) when liquid pressure is constant, (2) when it varies with time and (3) in an ultrasonic field. This is confirmed by numerical calculations. (auth)

22395 RESPONSE FUNCTIONS OF TELESCOPES USED IN COSMIC-RAY RESEARCH. Kolchin, A. A.; Lebedev, V. V.; Skrebtsov, G. P. (Inst. of Technical Physics, Leningrad). Instrum. Exp. Tech.; 17: No. 5, 1534(1974).

Translated from Prib. Tekh. Eksp.; No. 5, 232(1974).

It is shown that the response function of a telescope counter in an isotropic flux differs from the standard response function, and the method of derivation is given. (WHK)

22396 CRYOGENIC TRACK SPARK CHAMBER. Gorodkov, Yu. V.; Lyubimov, V. A.; Sidorov, I. A.; Soloshchenko, V. A. (Inst. of Theoretical and Experimental Physics, Moscow). Instrum. Exp. Tech.; 17: No. 6, 1597-1598(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 46-47(1974).

Tests results are given on a streamer chamber operating at atmospheric pressure with the working gas cooled to 77°K; the spatial resolution improves as the temperature is reduced, and the streamers become smaller, while the number of streamers per track increases, although the voltage required on the chamber hardly varies down to 77°K. (auth)

22397 INVESTIGATION OF THE CONSERVATION OF SPARK TRACKS FOR DUAL PULSE SUPPLY WITH PULSES HAVING ALTERNATING SIGNS. Avakyan, K. M.; Asatiani, T. L.; Ivanov, V. A.; Krishchyan, V. M.; Matevosyan, E. M. (Erevan Physics Inst.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1289-1291(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 43-45(1974).

The parameters of the tracks of charged particles in a wide-

gap spark chamber were investigated for long delays by means of dual supply with high-voltage radio pulses. It was shown that for a Ne + Ar(0.6%) + SF_6(5.10^{-5}%) mixture one may obtain high-quality tracks for delays of the high-voltage recording pulse equal to 0.25 to 1000 μsec. (auth)

22398 HIGH-ENERGY PARTICLES IN COSMIC RAYS. Grigorov, N. L.; Rapoport, I. D.; Shestoperov, V. Ya. Moscow; Izdatel'stvo Nauka (1973). 304p. (In Russian).

The book considers recent methods in the physics of cosmic rays — the method of ionization calorimeter and its combination with the means of visual observation of particles (the Wilson chamber, nuclei in a photoemulsion, spark chambers). A discussion is conducted of the basic results obtained by using these methods in the study of particles with energies of 10^{11} to 5.10^{12} ev. The paths of development of new methods of research for handling energy regions of 10^{13} to 10^{14} ev are considered. The book contains 122 illustrations, 41 tables, and 199 bibliographic references. (auth)

Radiometric Instruments

22399 (PB-231919) STATE OF THE ART: 1971 INSTRUMENTATION FOR MEASUREMENT OF PARTICULATE EMISSIONS FROM COMBUSTION SOURCES. Volume IV. Experiments and Final Report. Sem, G. J.; Borgos, J. A. (Thermo-Systems, Inc., St. Paul, Minn. (USA)). Sep 1973. Contract EPA-CPA-70-23. 123p. (EPA-650/2-73-022). NTIS $9.25.

The first phase of this program was a literature study and evaluation of potential measurement techniques and a more precise definition of stack environment. Volumes I and II of this report series contain the results of this study. The second phase was an experimental evaluation of the most promising technique: beta radiation attentuation. Section 2 describes early laboratory tests performed with the sensing head of a Geiman beta radiation instrument. Section 3 describes a sampling facility, designed specifically for the evaluation of the instruments which measure particle mass concentration of stack effluent. Section 4 describes results of the calibration of the sampling facilities in the field experiment station under several normal operating conditions. Section 5 describes tests of two prototype instruments with beta radiation particle mass sensors. The highly encouraging measurements indicate that the beta radiation sensing with filter collection of particles is a strong candidate for the measurement of particle mass concentration in smoke stacks. Section 6 presents candid comments regarding the state-of-the-art of commercial transmissometers in January 1971. (GRA)

22400 METHOD AND APPARATUS FOR REDUCING BACKGROUND IN INELASTIC GAMMA RAY LOGGING SYSTEMS. Culver, R. B. (to Dresser Industries, Inc.). US Patent 3,885,154. 20 May 1975. Filed date 26 Oct 1973. 6p.

The amplified pulses from a radioactivity detector are coupled through a delay line to a linear gate. The amplified pulses from the detector are also connected to a discriminator. The output of the discriminator is AND gated in a logical gate with a clock pulse which is synchronized with a high energy neutron source. The AND gate triggers a first single shot multivibrator which in turn triggers the linear gate. The delay line allows for the time required for the detector pulse to rise to the discriminator threshold and for the propagation delay in the logic circuitry. The linear gate opens before the arrival of the detector pulse and closes after it passes through. A J-K flip-flop circuit is triggered by the trailing edge of the output of the first single shot multivibrator to disable the AND gate, thus causing the linear gate to pass only the first detected pulse having the necessary discriminator level. The output of the AND gate is OR gated with the output of a second single shot multivibrator which is triggered off the trailing edge of the clock pulse. The output of the OR gate drives a negative high voltage pulser which is connected to a negative pulsing ring in a neutron generator. The leading edge of the clock pulse drives a positive high voltage pulser which is connected to a positive pulsing ring in the neutron generator. The neutron generator is thus extinguished upon the detection of the first detector pulse occurring within the clock pulse interval having the necessary discriminator threshold. In an alternative embodiment, a second AND gate is used to gate a source control clock pulse and the output from the J-K flip-flop to provide a driving pulse for the ion source pulser. (auth)

22401 CONTAMINATION PROBLEMS WITH ^{63}Ni ELECTRON CAPTURE DETECTORS. Gosselin, C.; Martin, G. B.; Boudreau, A. (Laval Univ., Quebec). J. Chromatogr.; 90: No. 1, 113-118 (Mar 1974).

A study was performed in two ^{63}Ni electron capture detectors operating in d.c. mode. Several parameters have been examined. It appeared that the temperature difference between the detector and the column is important. Scavenger gas temperature and detector isolation are not less important. Furthermore the detector polarization switch must always be off when no chromatogram is being run. These modifications help to keep the detector sensitivity much longer, with a consequent reduced number of washings. (auth)

22402 GAMMA–GAMMA METHOD ISSLEDOVANIYA NEFTYANYKH SKVAZHIN. (Gamma–Gamma Method of Investigating Oil Wells). Gulin, Yu. A. Moscow; Nedra (1975). 160p.

Theoretical and practical problems of the gamma–gamma method (GGM) are considered as applied to problems of documenting geological strata, and controlling the state of the well and development of the oil deposit. On the basis of an analysis and interpretation of the results of calculations carried out by the Monte Carlo method with the use of data from physical modeling, studies were made of the basic, physical regularities of the gamma–gamma method, both general regularities (spatial, energy and angular distribution of gamma quanta for an actual geometry), and also concrete regularities (characteristics and parameters of the measuring units). Accuracy requirements are estimated for determining the volume density of ores. Equipment is described for the gamma–gamma surveying of well strata, controlling the cementation quality and state of the casing, investigating the composition of the liquid in the column, and carrying out the measurements, especially calibrating the instruments. A look is taken at the technique of interpreting data from gamma–gamma surveying of the soft radiation component together with results from other types of study, the technique of determining the quality of cementation of the cased well, measuring its inner diameter and wall thickness, and the density and composition of the liquid in the well column. Conclusions are illustrated by examples. (SJR).

22403 AUTOMATION OF THE NUCLEAR GEOPHYSICAL TESTING FOR ORES. Meier, V. A.; Rozuvanov, A. P. Vestn. Leningrad. Univ., Geol., Geogr.; No. 4, 57-63(Dec 1974). (In Russian).

The automation of processing the information of radioisotope x-ray fluorescence borehole logging is dealt with. The tests of an automatic analyser were fulfilled at a tin ore deposit. The high precision of automatic investigation of the borehole by X-ray fluorescence analysis and the application of digital processing principles for field apparatus of nuclear geophysics is fixed. (auth)

22404 SELECTING DETECTOR IN γ-METHOD OF A BROAD BEAM OF MEASURING THE GROUND DENSITY. Zvol's'kii, S. T.; Vovk, P. K.; Molchanovs'kii, S. M. (Inst. of Biological Sciences, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. B; No. 4, 295-298(Apr 1975). (In Ukrainian).

The detectors on the basis of « CTC »-counters have the greatest relative sensitivity to the ground density. A less sensitivity is peculiar to the detectors on the basis of « BC »-counters and scintillation crystals. A relative sensitivity of these detectors within the range of small thicknesses of the measurable samples (up to 20 g/cm^2), which are mainly dealt with in measuring by the method of broad beams is especially small and, in addition, ambiguous. Discrimination of γ-quanta with the energy of E ≤ 0.2 MeV considerably increases the sensitivity of « BC »- and NaI-detectors and keeps their absolute sensitivity at a comparatively high level making it possible to apply such detectors to the method of broad beam for measuring the density of ground even with small thicknesses of its samples. (auth)

22405 AUTOMATED ACTIVATION ANALYSIS DATA ACQUISITION SYSTEM. Friedman, M. H.; Tanner, J. T. (Bureau of Foods and Drug Administration, Washington, DC). J. Radioanal. Chem.; 25: No. 2, 269-273(1975).

An automated neutron activation analysis data acquisition system was assembled from commercially available equipment. The modifications of the components needed to make this into a working system are described in the text. The main components of the data acquisition system are a sample changer, a Ge(Li) detector, a magnetic tape deck, and a minicomputer based multichannel analyzer. The sample changer has a 200-sample capacity and can handle both solid and liquid samples. Software for controlling the data acquisition system is flexible, yet simple to use. The system has operated reliably for a year and has sharply reduced the effort needed for data acquisition. (auth)

22406 LAYOUT OF MEASURING SYSTEMS WITH RADIOACTIVE SOURCES TO COMPENSATE PREPARATION DECAY. Mengelkamp, B.; Schneider, H. (to Hartmann und Braun AG). German(FRG) Patent 2,362,744/A/. 23 Jan 1975. 7p. (In German).

An arrangement to compensate the decay of preparations with radiometric gages is described. The receiver of the radiation

is connected to a time device which displaces a built-in potentiometer in the receiver circuit and thus corrects the fall in intensity of the radiator. (GE)

22407 MEASURING SYSTEM FOR A BOREHOLE PROBE. Lubecki, A.; Schmitz, H.; Wolf, R. (to Gesellschaft fuer Kernforschung mbH). German(FRG) Patent 2,347,037/S/. 3 Apr 1975. 13p. (In German).

A measuring system for a borehole probe using nondispersive X-ray fluorescence with beam collimation for the element analysis with a radiation source, a detector for X-ray fluorescence and/or Compton scattering and a shielding of the detector against direct radiation from the source are described. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

22408 (SAND-75-0371) CMOS LATCH-UP ANALYSIS AND PREVENTION. Shafer, B. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1975. Contract AT(29-1)-789. 19p. Dep. NTIS $4.00.

An analytical model is presented which develops relationships between ionization rates, minority carrier lifetimes, and latch-up in bulk CMOS integrated circuits. The basic mechanism for latch-up is the SCR action reported by Gregory and Shafer. The SCR is composed of a vertical NPN transistor formed by the N-channel source diffusion, the P-Well, and the N-substrate. The second part of the SCR is the lateral PNP transistor made up of the P-channel source diffusion, the N-substrate, and P-Well. It is shown that the NPN transistor turns on due to photocurrent-induced lateral voltage drops in the base of the transistor. The gain of this double diffused transistor has been shown to be as high as 100. Therefore, the transistor action of this device produces a much larger current flow in the substrate. This transistor current adds to that produced by the P-Well diode photocurrent in the substrate. It is found that the combined flow of current in the substrate forward biases the base emitter junction of the PNP device long before this could occur due to the P-Well photocurrent alone. The analysis indicated that a CD4007A CMOS device biased in the normal mode of operation should latch at about $2 \cdot 10^9$ rads/sec. Experimental results produced latch-up at 1 to $3 \cdot 10^9$ rads/sec. (auth)

22409 (SAND-75-5607) PROCESS CONTROLS FOR RADIATION HARDENED ALUMINUM GATE BULK SILICON CMOS. Gregory, B. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 7p. (CONF-750703-11). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

Optimized dry oxides have recently yielded notable improvements in CMOS radiation-hardness. By following the proper procedures and recipes, it is now possible to produce devices which will function satisfactorily after exposure to a total ionizing dose in excess of 10^6 RADS (Si). This paper is concerned with the controls required on processing parameters once the optimized process is defined. In this process, the pre-irradiation electrical parameters must be closely controlled to insure that devices will function after irradiation. In particular, the specifications on n- and p-channel threshold voltages require tight control of fixed oxide charge, surface-state density, oxide thickness, and substrate and p-well surface concentrations. In order to achieve the above level of radiation hardness, certain processing procedures and parameters must also be closely controlled. Higher levels of cleanliness are required in the hardened process than are commonly required for commercial CMOS since, for hardened dry oxides, no impurity gettering can be employed during or after oxidation. Without such gettering, an unclean oxide is unacceptable due to bias-temperature instability. Correct pre-oxidation cleaning, residual surface damage removal, proper oxidation and annealing temperatures and times, and the correct metal sintering cycle are all important in determining device hardness. In a reproducible, hardened process, each of these processing steps must be closely controlled. (auth)

22410 FABRICATION OF 3-TERMINAL TRANSFERRED-ELECTRON LOGIC DEVICES BY PROTON BOMBARDMENT FOR DEVICE ISOLATION. Upadhyayula, L. C.; Narayan, S. Y.; Douglas, E. C. (RCA Labs., Princeton, NJ). Electron. Lett.; 11: No. 10, 201-202(15 May 1975).

Proton bombardment has been used to convert n GaAs into high-resistivity material. This technique is used for isolating coplanar transferred-electron logic (t.e.l.) devices. The d.c. transfer characteristics of these devices show about 20% current drop. Preliminary experiments indicate that the device propagation delay is of the order of 50 ps. (auth)

Miscellaneous Instruments

Refer also to abstracts 22204, 22477, and 24028.

22411 (AERE-R-8033) VERY THIN SHIM COILS FOR AN NMR PROBE. Baker, C. A. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1975. 8p. Dep. NTIS (US Sales Only) $4.00. UK pounds 1.00.

In a previous report (AERE-R 7849 (1974)) which described the manufacture of a transverse quadrupole shim coil for the Varian HR 220 n.m.r. spectrometer, consideration was given to the design of coils which could be used on earlier models of the instrument, in which the space available for the coils is severely limited. Six designs were suggested which might possibly be constructed within the allowable thickness of 0.8 mm. Three of these designs have been considered in more detail. These are as follows: a single set of wire wound coils with foil crossovers; a double sided flexible printed-circuit; and a single sided flexible printed circuit. (auth)

22412 (ANCR-1225) COMPARISON OF FOUR TUNGSTEN ALLOYS FOR USE AS ULTRASONIC THERMOMETER SENSORS. Arave, A. E. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Jun 1975. Contract AT(10-1)-1375. 33p. Dep. NTIS $4.00.

Four tungsten alloy materials were evaluated for use as ultrasonic sensors: (a) tungsten, (b) tungsten-1 percent thoria, (c) tungsten-2 percent thoria, and (d) tungsten-26 percent rhenium. Four parameters were checked: (1) temperature sensitivity, (2) signal attenuation as a function of temperature, (3) temperature sensitivity as a function of frequency, and (4) relative signal attenuation as a function of frequency. The temperature sensors were designed for the Loss-of-Fluid Test (LOFT) and Power Burst Facility (PBF) reactors. (auth)

22413 (LBL-3819) APPLICATIONS AND DEVELOPMENT OF CAMAC IN NORTH AMERICA IN 1975. Mack, D. A.; Wagner, L. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 9 May 1975. Contract W-7405-ENG-48. 7p. (CONF-750521-3). Dep. NTIS $4.00.

From ISPRA symposium; Stresa, Italy (20 May 1975).

CAMAC is now a well established instrumentation system in North America. Research organizations outside of the National Laboratories and industrial users are finding that this modular instrumentation system for data handling is indeed a very practical and cost effective approach to Computer Aided Measurement and Control. Accordingly, this paper reviews applications of new developments in CAMAC during the past year and considers its future in view of related technological developments. (auth)

22414 (LBL-3860) SYSTEM OF COILS FOR INCREASING THE VOLUME OF HOMOGENEOUS FIELD BETWEEN THE PARALLEL POLE FACES OF AN ELECTROMAGNET. Nelson, D. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 14 Apr 1975. Contract W-7405-ENG-48. 53p. Dep. NTIS $5.75.

Thesis.

The design and evaluation of a system of coils for improving magnetic field homogeneity are discussed. Using only three coil-pairs the duration of NMR spin-echo signals from a sample of H_2O (0.7 cm, diameter x 0.9 cm, long) was increased by an order of magnitude. (auth)

22415 (UCRL-51682(Pt.7)) BEHAVIOR OF POROUS BERYLLIUM UNDER THERMOMECHANICAL LOADING. Part 7. Calibration Studies on the Carbon Piezoresistive Gage. Horning, R. R.; Isbell, W. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jun 1975. 13p. Dep. NTIS $4.00.

The calibrations, time responses, and Hugoniot for carbon piezoresistive gages from two manufacturers are presented. These gages exhibit a high sensitivity of about −20 percent resistance change per GPa at 0.5 GPa. Their equilibrium times, when tested in fused silica, exceed 0.6 mu s below 0.5 GPa but improve at higher stresses and under better impedance matching conditions. They can be made of low atomic number materials, making them interesting candidates for studying the mechanical responses of materials to electron and x-ray deposition. (auth)

22416 (WANL-TME-1849) DEVICE FOR HIGH VOLTAGE SURGE PROTECTION. Stearns, E. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Aug 1968. 25p. Dep. NTIS $4.25.

The memorandum presents a description of an electric furnace used to heat test specimens, and it describes furnace damage

caused by electrical arcs when a breaking specimen suddenly opens the inductive circuit. The device, which is applicable to any d-c circuit, provides a gap containing a dielectric material in parallel with the device to be protected. The gap is set to break down at a voltage well below the safe operating voltage of the device to be protected. A high voltage suddenly impressed on the parallel combination causes arcing across the gap and places a short circuit across the protected device. The current flow through the arcing circuit prevents further build-up of voltage to a level that might damage the protected device. (auth)

22417 (ZFK-280, pp 115-138) DEVICES AND METHODS. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, Ger.). Jul 1974. (In German).

In annual report, 1974. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

In addition to brief abstracts of research already reported in the literature, research is reported on photolithographic studies on the masking of Si discs for semiconductor detectors, removal of thin layers from P and B-implanted Si by anodix oxidation, chemical etch-polishing of monocrystalline Si, temperature device (-170° to 150°C) for the DK-2A spectral photometer, measurement installation for study of the electrochemical reactions at the Si/electrolyte phase boundaries and of the surface recombination rate, apparatus for the dynamic measurement of the differential capacity in Si electrodes, measurement plate for the determination of the complex dielectric constants of liquids with large electrical conductivity, measurement of F^- concentrations with a fluoride selective electrode, device for measurement of the oxygen partial pressure and contents of the reducing components in gases and oxides in metal melts, method for the Coulometric determination of small water concentrations in gases, automatic device for the determination of hydrogen fluoride in waste gases, flow-through measurement on gaseous UF_6 with supercritical perforated disc, separation of nuclides at different column fillings from hydrochloric acid, construction of a mechanized discharge device on the cyclotron for reduction of the dose rate with simultaneous increase of the sample permeation, automatic sample changer for nuclear radiation measurements, automatic digital deadtime and decay corrector, development of a system for the processing of radioactive materials in cells on a routine basis, remote-controlled automation of chemical operation for the production of radioactive preparations, testing of the technique developed for the production of sterile $^{113}Sn/^{113m}In$ generators, Na-resistant soldered joint, Na-resistant solders for metal-ceramic joints, and development of a new apparatus for the catalytic hydrogenation and dehalogenation of compounds for the preparation of tritiated compounds. (JSR)

22418 MULTICOUNTER RECORDING SYSTEM FOR A POWDER DIFFRACTOMETER. Golovin, A. E.; Merzlikin, A. P.; Vlasov, V. S.; Glazkov, V. P. (Inst. of Atomic Energy, Moscow). Instrum. Exp. Tech.; 17: No. 6, 1594-1596(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 43-45(1974).

A 10-detector recording system is described for a neutron diffractometer which reduces the recording time for a complete pattern by a factor 9 without loss of resolution or accuracy. An AI-256 analyzer is used, in which each channel corresponds to definite angular position for the detectors. (auth)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

22419 (ERDA-tr-32) SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. Vasaru, G. Jul 1975. Translated by F. Kertesz of Separarea Izotopilor Prin Termodifuzie, Publishing House of the Romanian Academy, Bucharest, 1972. 384p. Dep. NTIS $10.60.

Detailed information is presented on elementary thermal diffusion (TD) effect; TD and molecular models; experimental methods for determining TD factors and for analyzing the separation effect of TD; experimental and theoretical results for TD factors of gases and liquid isotopic mixtures; theory of the TD column and of the TD cascade; columns and cascades for TD experiments; and the application of TD to isotope separation. (LCL)

22420 (GSI-73-3, pp 65-77) JUELICH GAS-FILLED SEPARATOR "JOSEF". Lawin, H. (Kernforschungsanlage, Juelich, Ger.). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8-9, 1973.

One possible method for the separation of high-energy ions with broad energy and ion charge distributions, as from the fission of ^{235}U, is a gas-filled separator in which the region of the imposed magnetic field is filled with a gas such as He. The operational principle of such a separator is outlined. The design and properties of the JOSEF (Juelich on-line separator for fission products) is described. Results obtained on the fission product rate in the focal plane as a function of gas pressures of 2, 6, 10^{-4}, and 5×10^{-2} torr are shown graphically. (JSR)

22421 (LIB/Trans-557) THEORETICAL STUDY OF THE COUNTERCURRENT IN AN ULTRACENTRIFUGE-APPROXIMATE SOLUTION OF THE COUNTERCURRENT EQUATIONS. Jacques, R. Mar 1975. Translation by W. J. Buykx of CEA-R-4336. 35p. Dep. NTIS (US Sales Only) $4.75.

Integrating the linearized Navier-Stokes equations linearized along the whole length of the centrifuge results in a differential relation between the mean axial velocity and the centrifugal and viscosity forces on the ends. These equations are then integrated near the ends by a boundary layer approximation method. It is assumed that outside the boundary layer, the axial velocity reaches its mean value. The repartition of all physical quantities in the boundary layer and a differential equation between the mean axial velocity and the boundary conditions imposed on the ends are obtained. This equation, valid both for the mechanical and thermal counter-current is solved numerically. Its solution shows the existence of a second boundary layer close to the wall of the tube. The present theory extends Martin's in that it takes into account: (1) the action of pressure forces; (2) zero velocity on the wall with no transport; and (3) the interaction between mechanical and thermal effects which tend to decrease the efficiency and the intensity of the counter-current. (auth)

22422 (LIB/Trans-582) THERMAL COUNTERCURRENTS IN CENTRIFUGES. Soubbaramayer. Jun 1975. Translation by A. Bicevskis of CEA-R-4185. 16p. Dep. NTIS (US Sales Only) $4.00.

A linear theory is assumed for the thermal countercurrent in a gas centrifuge. Some approximations about the viscous forces are made, and it is shown that the problem reduces to that of searching for the eigenvalues and eigenfunctions of a fourth order linear differential operator. Calculations indicate that zero axial velocity occurs at 87% of the radius. It is also shown that the efficiency K is 85%. (auth)

22423 (LIB/Trans-583) APPROXIMATE SOLUTIONS TO THERMAL COUNTERCURRENT CENTRIFUGE PROBLEMS. Soubbaramayer. Jun 1971. Translation by A. Bicevskis of CEA-R-4186. 24p. Dep. NTIS (US Sales Only) $4.25.

Based on a linearized theory and also making other approximations, the determination of the velocity distribution in a centrifuge with thermal countercurrents is described. Symmetry is assumed for the temperature distribution as regards the two end covers. In particular, formal expressions are derived for the two parameters introduced by Cohen and Groth which influence the separation, namely, the normalized flow rate of the countercurrent m and the separation efficiency K. In order to provide a measure of the countercurrent force, an expression is also provided for the absolute flow rate of the countercurrent L. The expression for the efficiency K allows the determination of the optimum temperature distribution at the covers by setting K = 1. (auth)

22424 (UCCND-CSD-INF-38) SPECIES SEPARATION IN A CURVED SHOCK WAVE IN SUPERSONIC FLOW OF A GAS MIXTURE. Harris, W. L.; Tunstall, J. N.; Burris, J. H. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 13p. (CONF-750722-1). Dep. NTIS $4.00.

From 10th international shock tube symposium; Kyoto, Japan (14 Jul 1975).

This paper describes an extension and a synthesis of existing theoretical models of non-planar shock waves in gas mixtures. A means of predicting the modified Rankine-Hugoniot conditions and the species separation in gas mixtures in supersonic flow through curved, two-dimensional shock waves is presented. The results reported here are consistent with the structure of the shock being governed by the Navier-Stokes equations. The prediction algorithm is not limited by the mole fraction of the species in the gas mixture. The species are assumed to be non-reacting. The effects of mixture initial Mach number, initial mole fraction, free stream Reynolds number, component mass ratio, and shock standoff distance are described. Numerical results indicate that the species separation: (1) decreases with increasing polar angle; (2) increases with increasing mixture initial Mach number; (3) decreases with increasing shock standoff distance; and (4) decreases with increasing free stream Reynolds number. Consistent modified Rankine-Hugoniot conditions are also obtained. The analysis requires that the ratio of shock thickness to shock radius be of the order unity or less. An upper limit with regard to mixture initial Mach number and species mass ratio, beyond which the analysis is invalid, is described. (auth)

22425 (UCRL-51833) DISCUSSIONS OF BULK ATOMIC OR MOLECULAR SEPARATIONS BY RESONANT RADIATION PRESSURE. Rinehart, E. A.; Richardson, J. H.; Hrubesh, L. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 May 1975. Contract W-7405-Eng-48. 16p. Dep. NTIS $4.00.

Resonant radiation pressure has been produced by the transfer of photon momentum to an atom or molecule during resonant absorption of photon energy. It is believed that this pressure is large enough to induce atomic and molecular separations when a laser is used as a source. A model was developed to describe the motion of molecules (or atoms) with a diffusion-limited mobility, under the influence of laser-induced resonant radiation pressure. The time dependency of the process was examined for a cw laser in the bulk movement of a one-component gas. Thermodynamic calculations showed that the process should be efficient and substantial. Preliminary experimental results were not conclusive. Two additional experimental techniques have been examined: the use of a pulsating laser source; and the use of periodic withdrawals and replenishings of the mixture within the system. Applications in the bulk separations of isotopic mixtures and optical isomers are discussed. (auth)

22426 (UCRL-Trans-10891) EVALUATION OF ENRICHMENT BY CENTRIFUGAL SEPARATION: THE FUTURE OF THE CENTRIFUGAL-SEPARATION METHOD. Kanagawa, A. Translated from Genshiryoku Kogyo; 20: No. 2, 40-45(1974). 30p. Dep. NTIS $4.50.

A gas centrifuge plant for uranium enrichment is considered from the point of view of economic competition with other methods. Characteristics of the method are presented including: energy efficiency, the cascade, the separation coefficient, the equilibrium separation process, and capability as centrifugal pump. The structure of an individual gas centrifuge separator is described including the rotating cylinder, mechanisms for gas injection and extraction, mechanisms for counter-streaming of gas, the axle holder mechanism, the gas sealing mechanism, and the driving mechanism. (MCG)

22427 TRAY PERFORMANCE EVALUATION. Jones, D. W. (Du Pont de Nemours (E. I.) Co., Aiken, SC); Jones, J. B. Contract AT(07-2)-1. Chem. Eng. Prog.; 71: No. 6, 65-72(Jun 1975).

Gamma scanning and tray simulation have proven very useful and relatively inexpensive techniques for evaluating tray performance in the GS process for heavy water production. Broader use of these methods can be expected in the future. (auth)

22428 RENAISSANCE FOR HEAVY WATER. I. Production of Heavy Water. Brun, J.; Foeyn, T.; Randers, G. (Ingenioernytt; 11: No. 23, 6-9(13 Jun 1975). (In Norwegian).

A brief historical survey of the production of heavy water following the discovery of deuterium in 1932 is followed by a brief review of the chemical and physical properties of deuterium and heavy water. The following methods of separating heavy water

are discussed: distillation of water, distillation of hydrogen, distillation of ammonia, isotopic exchange between hydrogen sulphide and water, between hydrogen and steam, between hydrogen and ammonia and between hydrogen and methylamine, and electrolysis of water combined with distillation of water or hydrogen, or with isotopic exchange between hydrogen and steam. (NO)

22429 RENAISSANCE FOR HEAVY WATER. II. Applications and Future Prospects. Brun, J.; Foeyn, T.; Randers, G. Ingenioer-nytt; 11: No. 24, 4-7(20 Jun 1975). (In Norwegian).

The various methods of producing heavy water discussed in Pt 1 are compared and evaluated, and the production of heavy water in Canada, India, USA and Norway is reviewed. The use of heavy water as moderator in nuclear power plants is discussed with particular reference to the CANDU type of reactor, using the Pickering station as an example, and the SGHWR. Future prospects are also discussed. (NO)

22430 AERODYNAMIC SEPARATION METHODS. Campargue, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Chimie-Physique); Fenn, J. B. (Yale Univ., New Haven, Conn. (USA)); Hamel, B. B. (Drexel Univ., Philadelphia, Pa. (USA)); Muntz, E. P. (University of Southern California, Los Angeles (USA)); White, J. R.; Anderson, J. B. pp 287-288 of La maturite de l'energie nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French).

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Two less-well-known approaches to the enrichment problem, the jet membrane and the separation probe are summarized. Some proposals based on interactions between jets and molecular beams are mentioned. (FR)

22431 OTHER PROCESSES FOR URANIUM ISOTOPE SEPARATION. Kakihana, H. (Tokyo Inst. of Tech. (Japan)); Frejacques, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Div. de Chimie). pp 288-289 of La maturite de l'energie nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French).

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Various processes based on thermodynamical equilibria, especially on chemical exchanges and electromagnetic processes are reviewed. (FR)

22432 METHOD AND EQUIPMENT OF SEPARATION OF GASEOUS AND VAPOROUS MATERIALS, PARTICULARLY ISOTOPES, WITH SEPARATION NOZZLES. Becker, E. W.; Eisenbeiss, G.; Ehrfeld, W. (to Gesellschaft fuer Kernforschung mbH). German(FRG) Patent 2,338,893/S/. 27 Feb 1975. 25p. (In German).

The separation nozzle method was improved by the two following steps: (1) The partial flows produced within the cascade with various shares of additional gas are introduced into the separating nozzle systems in such a manner that with regard to the additional gas, a molar fraction gradient is created which is in the opposite direction to the gradient created by the separation process. (2) The partial flows produced within the cascade with various compositions of the mixture of substances to be separated are introduced into the separating nozzle systems in such a manner that, regarding the substances to be separated, a molar fraction gradient is created that is in the same direction as the molar fraction gradient formed by the separation process. Both measures can be separately applied or in combination with one another; flowsheets of the invented cascade circuits and separating nozzle systems are given. (GE)

Isotopic Power Sources

Refer also to abstracts 22184, 22188, and 22643.

22433 (BNWL-1060) SPACE ELECTRIC POWER PROGRAM, SPACE NUCLEAR SYSTEMS DIVISION QUARTERLY PROGRESS REPORT, JANUARY–MARCH 1969. Hansen, J. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1969. Contract AT(45-1)-1830. 58p. Dep. NTIS $6.00.

Declassified 29 Aug 1973.

Microballoon development studies have been completed, and a summary of the process is presented, including economic determinations. Rhenium microballoons were fabricated for the purpose of evaluating chemical vapor deposition (CVD) rhenium. The CVD rhenium process was improved to a 6 to 8μ/hr deposition rate capability. Linear materials are being sputtered onto polonide fuel surfaces, but some difficulty has been experienced in maintaining the glove box sputtering equipment. Rare earth-polonium fueling studies have indicated a dysprosium-polonium fuel compound which exhibits significantly lower vapor pressure than fuel compounds obtained previously. After special heat treatment, the fuel obtained did not release polonium between 900 and 1200°C (> 30 hr) when a surface cool enough for polonium condensation was available. Fuel containment studies have verified that previous test results in which polonium was released through refractory metal claddings was due to polonium vapor, and not due to the rare earth or other materials in the microsphere system. Fuel containment tests are in progress for the new fuel which promise greater stability against polonium release. Diffusion testing has indicated that at least one diffusion barrier would be required for microsphere operation above 1000°C. Successful oxidation protection of microspheres has been limited to 3 hr in air at 900°C. (auth)

22434 (BNWL-1116) FINAL SUMMARY REPORT: POLONIUM ENCAPSULATION PROGRAM, SPACE ELECTRIC POWER OPERATION, SPACE NUCLEAR SYSTEMS DIVISION. Hansen, J. E. (ed.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1969. Contract AT(45-1)-1830. 74p. Dep. NTIS $6.75.

Declassified 30 Aug 1973.

The development of a ^{210}Po microencapsulation concept at Pacific Northwest Laboratory is summarized. The encapsulation concept utilized microspheres which are individual heat sources possessing a central void volume for helium containment, a rare earth polonide fuel compound, a polonium containment cladding, a structural cladding, and an oxidation resistant cladding. This program was primarily developmental in nature. Thin film deposition processes were developed for fabrication of specific microsphere claddings. Chemical vapor deposition (CVD) processes were developed for deposition of tungsten, tantalum, and rhenium on microspheres in a fluidized bed. Vacuum vapor deposition (VVD) processes were developed for depositing the rare earths, gadolinium, erbium, and dysprosium on refractory metal, microsphere substrates. Vacuum sputtering (VS) processes were developed for depositing rhenium and molybdenum directly onto polonium-bearing microsphere surfaces. The VS technique was also used to prepare diffusion barriers of Al_2O_3 and ZrO_2. Several techniques were developed for handling microspheres in the 200 to 500 μ size range, and for inspecting and evaluating microsphere properties. A technique was developed for performing metallography directly on polonium-bearing samples. (auth)

22435 (BNWL-1177(Suppl. 1)) PACIFIC NORTHWEST LABORATORY, DIVISION OF ISOTOPE DEVELOPMENT PROGRAMS QUARTERLY REPORT, MAY 1969–JULY 1969. Supplement. Sheely, W. F. (ed.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1969. Contract AT(45-1)-1830. 11p. Dep. NTIS $4.00.

Declassified 29 Aug 1973.

Progress during May to August 1969 in studying materials for encapsulating radioisotope heat sources is reported. Promethium metal and promethium oxide compatibility tests with various cladding metals, i.e., Ta, Ta/10 W, W, Re, and Re/26 W, are described and the test results tabulated. (LCL)

22436 (BNWL-1845-10) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO SPACE NUCLEAR SYSTEMS DIVISION FOR APRIL 1975. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-1830. 23p. Dep. NTIS $4.00.

At Hanford, strontium will be separated from the high-level waste, then converted to the fluoride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation and storage will take place in the Waste Encapsulation and Storage Facilities (WESF). This encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat source applications under anticipated use conditions. The objectives of this program are to obtain the data needed to license $^{90}SrF_2$ heat sources and specifically the WESF $^{90}SrF_2$ capsules. The information needed for licensing can be divided into three general areas: long-term SrF_2 compatibility data; chemical and physical property data on $^{90}SrF_2$; and capsule property data such as external corrosion resistance, crush strength, etc. The current program is designed to provide the required information. (auth)

22437 (BNWL-1845-11) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO SPACE NUCLEAR SYSTEMS DIVISION FOR MAY 1975. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-1830. 8p. Dep. NTIS $4.00.

At Hanford, strontium will be separated from the high-level waste, then converted to the fluoride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation and storage will take place in the Waste Encapsulation and Storage Facilities (WESF). This encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat source applications under anticipated use conditions. The objectives of this program are to obtain the data needed to license $^{90}SrF_2$ heat sources and specifically the WESF $^{90}SrF_2$ capsules. The information needed for licensing can be divided into three general areas: long-term SrF_2 compatibility data; chemical and physical property data on $^{90}SrF_2$; and capsule property data such as external corrosion resistance, crush strength, etc. The current program is designed to provide the required information. (auth)

22438 (LA-5916) PERFORMANCE OF MULTIHUNDRED-WATT FUELED-SPHERE ASSEMBLIES IN THE SAFETY SEQUENTIAL TEST PROGRAM. Cramer, E. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 22p. Dep. NTIS $4.00.

Five fueled-sphere assemblies similar to those proposed for use in the multihundred-watt radioisotope thermoelectric generator were subjected to conditions simulating earth impact after orbital abort. Of the five, one had no visible cracks, two had superficial cracks whose penetration of the iridium containment shell was not verified by metallography, one was obviously ruptured, and the fuel of one was exposed. The basic causes of containment failure were as follows: large-grained iridium provided short, straight boundary paths susceptible to intergranular fracturing; large plutonia fragments produced excessive tensile strain in the containment where it was forced to bend over their projecting edges at the moment of impact; vents failed because of sintering and CVD of nonmetallic materials in the filter frits; and, of less significance, directional grain growth in closure welds apparently caused one failure. (auth)

22439 (LA-5932) DEGRADATION OF PIONEER-TYPE TANTALUM ALLOY-PuO_2 HEAT SOURCES. Mulford, R. N. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 14p. Dep. NTIS $4.00.

The tantalum alloy T-111 is evaluated for the strength member in Pioneer-type heat sources. Emphasis is on the alloy's retention of ductility during the period between manufacture and launch. Test results of several heat sources that were operated in generators during the Pioneer program are given along with predictions of storage lifetime. The properties of T-111 as a function of oxygen content are assessed. The conclusion is that oxygen concentrations up to 400 ppM by weight are acceptable for launch. (auth)

22440 (MLM-2237) INVESTIGATION OF THE PROBLEMS ASSOCIATED WITH THE Pt-20 Rh CLADS OF THE VIKING HEAT SOURCES VF-3 AND VF-7. Zielinski, R. E. (Mound Lab., Miamisburg, Ohio (USA)). 25 Jul 1975. Contract AT-33-1-GEN-53. 102p. Dep. NTIS $5.45.

The investigation was undertaken to determine why the emissive coatings of the Viking Heat Sources VF-3 and VF-7 had flaked off the Pt-20 Rh clad material. During the course of the investigation, two additional, unusual phenomena were observed: a surface reaction zone on the uncoated Pt-20 Rh surfaces and grain boundary reactions in the weld zone of the clad. It seems that all three phenomena were the result of a complicated reaction couple that involved the heat source materials, storage container materials, and environment. Vapor transport mechanisms were responsible for the phenomena which were obeserved. The vapor transport mechanisms were probably initiated because of the impurities that were in both the heat source and storage container materials. The mechanisms resulted in significant changes in these heat sources because vapor transport was allowed to continue in a static environment for an unusually long period of time. (auth)

22441 (ORNL-4131) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING MARCH 31, 1967. Lamb, E. (Oak Ridge National Lab., Tenn. (USA)). May 1967. Contract W-7405-eng-26. 36p. Dep. NTIS $5.00.

Declassified 6 Sep 1973.

The fabrication and composition of compatibility couples and test procedures for determining the compatibility of curium oxide and candidate encapsulation materials including tantalum, T-111, molybdenum, TZM, tungsten, and W-26% Re are detailed for 1000- and 10,000-hr exposure periods. An apparatus for measuring the vapor pressure of curium oxide by the transpiration method is described. The best thermocouple material for the ^{244}Cm calorimeter was determined to be chromel-constantan when type 347 stainless steel is used as the thermal conductivity metal. Properties of ^{90}Sr fuel forms which were investigated included the thermal conductivity of Sr_2TiO_4, $SrTiO_3$, and SrO pellets at different temperatures and dissolution rates of SrO pellets in distilled water and seawater. The heat output of ^{90}Sr in equilibrium with ^{90}Y was determined to be 0.00686 ± 0.00023 w/curie by calorimetric measurement and radiochemical analysis of $^{90}SrCO_3$. The total weight requirements (source and shield) for fuel forms of ^{60}Co and ^{90}Sr are compared on the basis of end-of-life power levels for missions of two and five years. The status of sol-gel development in the $^{238}PuO_2$ microsphere program is described. The thermal power of the SNAP-11 heat source was calorimetrically measured, and the disassembly and inspection of the SNAP-11 fuel block are reported. Welds made on Hastelloy C capsules (to be used for the SNAP-21 generator) are illustrated. (auth)

22442 (ORNL-4174) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING JUNE 30, 1967. Lamb, E. (Oak Ridge National Lab., Tenn. (USA)). Aug 1967. Contract W-7405-eng-26. Dep. NTIS $4.75.

Declassified 6 Sep 1973.

The apparatus for determining the vapor pressure of curium oxide by the transpiration method was constructed and tested. Equipment to be used for testing inert-atmosphere systems and the operation of a Tian-Calvert solution calorimeter are described. The minimum weight of capsules (for the thermionic program) containing 1 kw_{th} of $^{244}Cm_2O_3$ and an analysis of the effects of failure criteria, length-to-diameter ratio, and operating temperature are given. Thermal conductivity data of SrO, Sr_2TiO_4, and $SrTiO_3$ were correlated and treated statistically to assess the errors. The results show that satisfactory thermal conductivity values can be determined using 1/2-in.-high by 1-in.-dia uninstrumented disks. Thermal conductivity versus temperature curves and a curve depicting the error due to variable interface conductivity are given. The oxidation resistance of capsule materials (Hastelloy C, Inconel 600, and platinum) in air at 2000°F and the corrosion resistance at 2000°F in clay-type soil common in the vicinity of ORNL were determined over a period of three months. The status of sol-gel development in the $^{238}PuO_2$ microsphere program is given. The SNAP-7A generator was defueled and inspected, and the heat output of the four capsules was determined and compared with the output at the start of operation. The disassembly and inspection of the SNAP-11 fuel block was completed. The weld development for the SNAP-21 program and the radiation mapping of the generator assembly using a 202-w ^{90}SrO source to simulate the SNAP-21 fuel are described. (auth)

22443 (ORNL-4237) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING DECEMBER 31, 1967. Lamb, E. (Oak Ridge National Lab., Tenn. (USA)). Feb 1968. Contract W-7405-eng-26. 34p. Dep. NTIS $4.75.

Declassified 6 Sep 1973.

Samples of Nd_2O_3 microspheres doped with natural boron were irradiated to simulate helium release from $^{244}Cm_2O_3$. The spectrochemical determination of silicon in $^{244}CmO_2$ was investigated using ThO_2 as a stand-in for CmO_2. The calorimeter for the assay of ^{244}Cm shipments was calibrated and shipped to Savannah River. Techniques were developed for preparing and hot pressing curium oxysulfide pellets by using cerium as a stand-in for curium. The first set of compatibility couples of $^{244}Cm_2O_3$ and several refractory metals was fabricated and exposed to 1650°C for 1000 hr. The welding characteristics of superalloys for the encapsulation of ^{90}Sr fuel were studied by using type 304 stainless steel. The weight changes of type 316 stainless steel, Hastelloy C, and Haynes 25 specimens exposed to $SrTiO_3$ and Sr_2TiO_4 at 1100°C for 1000 hr were determined. The effect of thermal gradients on the compatibility of certain oxides was determined by using graphs of temperature versus equilibrium partial pressure of oxygen. The oxidation resistance of capsule materials (Hastelloy C, Inconel 600, and platinum) in air at 2000°F and the corrosion resistance at 2000°F in clay-type soil were obtained for periods up to 9 months. A series of tests was made to measure the surface temperatures of a source capsule buried in a wooden box containing soil. Microspheres of $^{239}PuO_2$ were prepared by the sol-gel process using intermediate-scale equipment in glove boxes and equipment on a pilot-plant scale. The four disassembled SNAP-7A capsules were visually and metallographically examined; there was no evidence of gross incompatibility or weld defects. A temperature profile of the SNAP-23A source was calculated assuming that the capsule was mounted in an electron-beam welder under vacuum with vacuum gaps in the interior of the capsule. (auth)

22444 (ORNL-4285) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING MARCH 31, 1968. Lamb, E. (Oak Ridge National Lab., Tenn. (USA)). May 1968. Contract W-7405-eng-26. 27p. Dep. NTIS $4.50.

Declassified 6 Sep 1973.

The "apparent diffusion coefficients" for $^{244}Cm_2O_3$ microspheres in the range of 390 to 1200°C and for $^{244}Cm_2O_3$ pellets in the range of 1100 to 1400°C were determined from helium release experiments. Samples of irradiated and unirradiated neodymium oxide microspheres (used as a stand-in for $^{244}Cm_2O_3$ in helium release experiments) were examined metallographically. Five batches of curium oxide were analyzed by the emission spectrographic technique. Equipment for the vapor pressure measurement of curium oxide by the transpiration method was constructed and tested. The compatibility couples of several refractory metals exposed to $^{244}Cm_2O_3$ for 1000 hr at 1650°C were examined. Results of compatibility tests of Haynes alloy No. 25, Hastelloy C, and type 316 stainless steel in combination with nonradioactive $SrTiO_3$, Sr_2TiO_4, and SrO for 1000 hr at 1100°C were analyzed. The thermal conductivity of a $^{90}SrTiO_3$ pellet from the SNAP-7A source was measured. The oxidation resistance of capsule materials (Hastelloy C, Inconel 600, and platinum) in air at 2000°F and the corrosion resistance at 2000°F in clay-type soil were obtained for periods up to 12 months. Heat transfer data obtained by measuring the surface temperature of a source capsule buried in a wooden box containing soil and the equation derived for predicting the capsule surface temperature when the capsule is buried in an infinite medium were evaluated. Equipment for studying the helium release from $^{238}PuO_2$ was assembled and tested. The preparation of $^{238}PuO_2$ microspheres by the sol-gel process was attempted. The SNAP-21 generator was tested for 60 days. Four welds on two fueled capsules were inspected using the ultrasonic equipment received from Pacific Northwest Laboratory. (auth)

22445 (ORNL-4363) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING SEPTEMBER 30, 1968. Lamb, E. (Oak Ridge National Lab., Tenn. (USA)). Dec 1968. Contract W-7405-eng-26. 44p. Dep. NTIS $5.25.

Declassified 6 Sep 1973.

Experiments have been devised to determine the rate of vapor phase migration of Cm_2O_3 encapsulated in tungsten. A compatibility program was formulated to evaluate container materials with $^{244}Cm_2O_3$ at 750 and 1200°C for thermoelectric and Brayton cycle applications. A new family of brazing alloys has been formulated as a result of the 100-hr braze specimen aging studies at 1650°C in vacuums of 10^{-8} torr. Creep-rupture testing of the tantalum alloy T-111 under varying stress and temperature is in progress. A creep test of wrought, powder-metallurgy-derived tungsten wire was successfully completed. The creep strength of tungsten progressively deteriorates as the oxygen pressure increases. Two additional conceptual designs for a vented 1-kw $^{244}Cm_2O_3$ thermionic test heat source have been proposed. The thermal conductivities of $^{90}SrTiO_3$ samples have been determined in the annealed and unannealed conditions. Data on the leach rates continue to follow the parabolic law within the precision of the experiments. One percent silica of 0.012-μm size mechanically dispersed in $SrTiO_3$ is effective in improving the density of hot-pressed pellets. Determinations of the apparent diffusion coefficient of helium in $^{238}PuO_2$ were made by measuring the helium concentration in microspheres after steady-state helium release had been attained. The technique for forming small-diameter (<63 μm) microspheres was studied by using the normal two-fluid nozzle. The top and bottom closure welds of SNAP-21 capsules were inspected by the pulse-echo ultrasonic technique. Three SNAP-23 test specimens were welded with the machined groove at the new design depth of 0.170 in. below the capsule top. (auth)

22446 (ORNL-4388) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING DECEMBER 31, 1968. Lamb, E. (Oak Ridge National Lab., Tenn. (USA)). Feb 1969. Contract W-7405-eng-26. 26p. Dep. NTIS $4.50.

Declassified 6 Sep 1973.

Twenty-three compatibility couples for 5000- and 10,000-hr tests at 1850°C have been completed and are ready for exposure to temperature. Three of the group of new brazing alloys exhibited excellent wettability on tungsten and were used in simulated capsule-to-emitter brazes. Necessary data have been obtained to indicate the selective loss of tungsten from the tungsten-rhenium alloy in low-pressure oxygen. The effect of cycling the oxygen pressure between 10^{-8} and 10^{-6} torr on the creep rate of an arc-cast-derived tungsten wire was determined. Flow parameters were developed and used in an effort to coat 500-μm ThO_2 particles with tantalum. Purification of ^{244}Cm oxide was achieved by two sequential oxalate precipitations under closely controlled conditions of activity, temperature, and time. Evaluation of compatibility couples of Hastelloy C, Haynes alloy No. 25, and type 316 stainless steel with $SrTiO_3$, Sr_2TiO_4, and SrO continued. Experiments to measure the current total helium inventory in the 370 and Dart I $^{238}PuO_2$ fuels were performed. Metallographic examination of heat-treated $^{238}PuO_2$ microspheres is underway. Ordered alloy systems are being investigated in an effort to develop improved alloys for space applications. Creep tests on Haynes alloy No. 25 were completed and tests to determine the creep-rupture properties were begun. The SNAP-23 source capsule was loaded with 1127 w_{th} of $^{90}SrTiO_3$, welded, and then loaded into the U-8% Mo shield. (auth)

22447 (SC-PR-69-706) SPACE ISOTOPE POWER PROGRAM QUARTERLY REPORT, JULY-SEPTEMBER 1969. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1969. 66p. Dep. NTIS $6.50.

Declassified 2 Nov 1971.

Progress during July to October 1969 in the development of the SNAP 19, the Transit radioisotope thermoelectric generator, an isotope fueled Brayton cycle power system, isotopic thermionic converters, and of the ^{60}Co heat sources, thermoelectric materials, and fuel capsule materials for these spacecraft power systems is reported. (LCL)

22448 HEALTH PHYSICS STANDARDS FOR CARDIAC PACEMAKERS. Rayonnem. Ionis. Tech. Mes. Prot.; No. 1, 30-32 (Jan 1975). (In French).

The safety criteria applicable to the design of the stimulator and of its battery and radioisotope source are announced: physical and chemical form of the fuel; containment (isolation of the radioisotope fuel, compatibility of the materials, containment lifetime); external radiation. It is stressed that all radioactive substances must be recovered at the final stage and evacuated under controlled conditions, which implies the labeling of the radioisotope source, battery case, and stimulator. (FR)

Radiation Sources

Refer also to abstracts 22417 and 23544.

22449 (CONF-750723-1) INTENSE 14 MeV NEUTRON SOURCE USING A SPHERICAL DRIVE-IN TARGET. Kim, J.; Morgan, O. B. (Oak Ridge National Lab., Tenn. (USA)). 11 Jul 1975. 13p. Dep. NTIS $4.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

A 14 MeV neutron radiation test facility using a drive-in spherical-shell target is discussed. This concept is based on a modest extrapolation of the present ion source technology and the drive-in target principle. Beams of equally mixed deuterons and tritons from ion sources are driven into a spherical target (diameter approximately 20 cm) from all directions. The inside of the spherical shell is accessible through two ducts for neutron irradiation samples, providing a large irradiation space with no significant variation in neutron flux densities. The expected neutron source intensity at the shell is S approximately 2×10^{12} n/cm^2 sec for a 300 keV-15 mA/cm^2, D-T mixed beam on a titanium target. The neutron flux obtained inside the shell increases monotonically with the radial distance from the minimum phi equals S at r equals 0 to, for instance, phi equals 1.65 S at r equals 0.9 a, where a is the radius of the spherical shell. This facility has a unique advantage in that a number of irradiation experiments can be performed simultaneously and a fairly uniform neutron flux can be obtained over an irradiation sample of large size. The target is designed to handle 4 to 5 kW/cm^2 of beam power by utilizing a "shell" of vortex-flow generators. D-T mixed gas is continuously recirculated and the target plating is done in-situ. Preliminary design ideas will be discussed. (auth)

22450 NEUTRON FLUX DISTRIBUTION AND THE AVERAGE NEUTRON FLUX DENSITY COMPUTED IN THE CAVITY SPACE OF A ^{241}Am-Be NEUTRON SOURCE OF ANNULAR SHAPE. Vaenskae, R. A.; Blomster, K. A.; Rieppo, R. M. (Univ. of Oulu, Finland). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 399-401(Jun 1975).

The neutron flux distribution and the average neutron flux density have been computed for a ^{241}Am-Be neutron source of annular shape by the Monte Carlo method using a Univac 1108 computer. The present work suggests that a 7 Ci annular ^{241}Am-Be neutron source (CIS, SNA-4) producing about 1.5×10^7 neutrons per second maintains an average flux density of 3×10^5 n/cm^{2}sec in the cavity space. (auth)

22451 NEUTRON POLARIZATION AT HIGH ANGULAR RESOLUTION. Elyutin, N. O.; Somenkov, V. A.; Shil'shtein, S. Sh. Instrum. Exp. Tech.; 17: No. 6, 1591-1593(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 40-42(1974).

Methods for polarizing thermal neutrons under the conditions of the high angular resolution attainable with a two-crystal spectrometer are discussed. The Stern-Gerlach method and the refraction polarization method, based on the phenomenon of bire-

fringence at the interface between air and a magnetic material, are used to deflect the beams through angles much larger than the angular width of any of the beams. (auth)

Design and Fabrication

22452 METHOD FOR PREPARATION OF A CERAMIC STRONTIUM-90 TITANATE β-RAY SOURCE. Enomoto, S.; Senoo, M.; Maeda, S. (Japan Atomic Energy Research Inst., Ibaraki). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 363-366(Jun 1975).

A new method is proposed for preparing a ceramic ^{90}Sr titanate β-ray source. A thin ^{90}Sr titanate layer is produced by firing a titanium dioxide base disc, onto which a ^{90}Sr nitrate solution has been added and dried. Formation of the thin strontium titanate layer is observed by x-ray diffractometry, and its effective thickness is estimated radiometrically. The thin layer with the effective thickness much smaller than the β-ray saturation thickness value is successfully obtained by the method. This method is simple and radiologically safe. (auth)

Industrial Uses

Refer also to abstract 22492.

22453 (AED-CONF-75-061-043) POTENTIAL OF RADIATION STERILIZATION IN SOLID WASTE TREATMENT. A Status Report. Padova, R.; Lapidot, M.; Molco, M.; Ross, I. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1975. 18p. INIS.

From international symposium on the use of high-level radiation in waste treatment--Status and prospects; Muenchen, F. R. Germany (17 Mar 1975).

3 tabs.; 38 refs. With abstract. Available from ZAED.

Different categories of solid waste are examined from the viewpoint of origins, characteristics and quantities. The composition of household garbage in a Mediterranean municipal zone has been determined in the course of one year, demonstrating the potential application of ionizing radiation to sterilization of certain raw materials (putrescible matter, plastics and paper stock) obtained after separation of the garbage into components. An economic feasibility study of a planned separation and processing plant (1,000-1,200 ton/day) is discussed. A pilot plant (200 to 300 ton/day) to demonstrate the technologic and economic feasibility of the process is described as is research presently being conducted in several institutes for the production of radiation sterilized feed. The potential of ionizing radiation in solid waste treatment, as a tool facilitating resource recovery from solid municipal and agricultural wastes, is evaluated on the basis of the data presented. (auth)

22454 (KFK-2096) ACTIVATION OF METALLIC MACHINE PARTS WITH CHARGED PARTICLES FOR WEAR MEASUREMENTS. Herkert, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Isotopentechnik). May 1975. 48p. (In German). Dep. NTIS (US Sales Only) $5.50.

The activation of various technical important metals is discussed. Titanium, chromium, iron, copper, zinc, and molybdenum were irradiated with protons, deuterons and α-particles on a cyclotron. The charged particles with energies up to 100 MeV generate radionuclides in the activated materials along their penetrating path of a few millimeters. The distribution of these nuclides was evaluated by stepwise grinding of the thick targets and by measurement of the residual activity. Information is given about some basis on activation, the practical execution of irradiations on a cyclotron and the radioactivities produced. The investigations are being continued with other materials with regard to the application of wear measurements. (auth)

22455 (SAND-75-0436) WASTE RESOURCES UTILIZATION PROGRAM. Progress Report, Period Ending 30 June 1975. (Sandia Labs., Albuquerque, N. Mex (USA)). Aug 1975. Contract AT(29-1)-789. 34p. Dep. NTIS $4.75.

Initial progress on the Waste Resources Utilization Program, a joint effort sponsored by ERDA and EPA under the terms of Interagency Agreement E(29-2)-3536/EPA-IAG-D5-0675 is reported. This program has as its objective the use of $^{134}Cs/^{137}Cs$ (a potential nuclear reactor "waste resource") as a gamma radiation source, coupled with modest heating, to treat sewage sludge (another "waste resource") to rid it of pathogenic organisms so that it may be safely used as a fertilizer or a feed supplement for ruminant animals. The potential exists for using at least 50 percent of the by-product cesium from future reactor fuel-rod reprocessing in this one application alone. Activities dealing with research on many aspects of the problem such as pathogen reduction, physical and chemical effects, cost benefit analysis, safety and security, and systems engineering are reported. (auth)

22456 PROCEDURE FOR INCREASING THE CHEMISORPTION CAPACITY OF CARBON FOR POISONOUS AND INDUSTRIAL WASTE GASES. Berg, R.; Hjelmstad, H. P.; Neefjes, G. A. (to Institutt for Atomenergi). Norwegian Patent 1,315,535/B/. 25 Jun 1973. 6p. (In Norwegian).

A procedure for increasing the chemisorption capacity of activated charcoal for poisonous gases and undesirable industrial waste gases by subjecting the activated charcoal to a gamma radiation dose of at least 1 Mrad in a nitrogenous atmosphere is described. It has surprisingly become apparent that by increasing the nitrogen pressure for a given radiation a further increase in chemisorption capacity may be achieved. The new invention is illustrated by examples with chlorine cyanide, hydrogen cyanide, sulphur dioxide and carbon monoxide. (NO)

22457 ^{170}Tm GAMMA SCATTERING TECHNIQUE FOR THE DETERMINATION OF ABSOLUTE BONE DENSITY. Olkkonen, H.; Karjalainen, P. (Kuopio Central Hospital, Finland). Br. J. Radiol.; 48: No. 571, 594-597(Jul 1975).

A new technique for the determination of absolute bone density is described. The procedure was based on the measurement of both transmitted and scattered photons emitted from a 650 mCi radioisotope source of ^{170}Tm in a narrow beam geometry. The method takes into consideration the change in the effective Z/A as a function of bone density which is due to the changing of the elementary composition of bone when bone mineral is resorbed. The experimental results showed that the density of homogeneous materials could be measured with a reproducibility of 2%. The bone density values for the 24 bone specimens measured by the new method showed a good correlation ($r = 0.94$) with results obtained by application of Archimedes' principle. (auth)

LIFE SCIENCES

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Refer also to abstracts 21963, 22009, 22479, 22480, 22493, 22500, 22574–22577, 22579, 22585, 22587, 22996, and 23375.

22458 (ERDA-tr-31, pp 12-17) INDUCTION BY GAMMA RADIATION OF LIGASE-SPECIFIC BREAKS IN BACTERIAL DNA IN VIVO. Fomenko, L. A.; Gaziev, A. I. (Inst. of Biological Physics, Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 811-815(1974).

In Radiobiology.

The formation of ligase-specific breaks in DNA isolated from irradiated (5 to 20 krad) cells of Bac. subtilis was demonstrated by the method of sedimentation in alkaline sucrose gradient and genetic transformation. Such breaks are repaired by ligase under conditions of incubation with DNA in vitro. The participation of DNA ligase in the repair of DNA in the irradiated cell was demonstrated by the incubation of irradiated and toluene-treated bacteria in the presence of the cofactor of this enzyme, NAD. It was found that ligase repair of DNA in the cell after the addition of a cofactor can be observed directly only when the bacteria are irradiated at a dose of 10 krad. At higher doses (20 to 30 krad), a significant restoration of the molecular weight of DNA is recorded only after the introduction of 4dNTP, substrates for the DNA-polymerase reaction, into the incubation medium. (tr-auth)

22459 (ERDA-tr-31, pp 18-23) IMMUNOGENIC ACTIVITY OF IRRADIATED SINGLE-STRANDED DNA. Moskalenko, I. P.; Mitryaeva, N. A.; Aleshina, V. N. (Kharkov Scientific Research Inst. of Medical Radiology). 1974. Translated from Radiobiologiya; 14: No. 6, 816-819(1974).

In Radiobiology.

The immunization of rabbits with single-stranded DNA, irradiated at a dose of 60 kR, leads to the appearance in their sera of antibodies with higher titers in comparison with the analogous nonirradiated DNA. The fractionation of sera containing antibodies for irradiated single-stranded DNA on Sephadex G-200 with further treatment with 2 beta-mercaptoethanol, permits their assignment to the 19S type. Complete exhaustion of the sera containing antibodies for irradiated single-stranded DNA on DEAE-cellulose, loaded only with related DNA, suggests the formation in the latter of regions modified under the action of radiation, expanding the immunogenetic efficiency of single-stranded DNA. (tr-auth)

22460 (ERDA-tr-31, pp 24-27) INFLUENCE OF IRRADIATION ON THE RIBONUCLEASE ACTIVITY OF THYMUS AND LIVER CHROMATIN OF RATS. Umanskii, S. R.; Skonikova, O. I.; Piker, E. G.; Tokarskaya, V. I. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 820-823(1974).

In Radiobiology.

Chromatin isolated from the rat liver and thymus possesses ribonuclease activity with two pH optima, in the acid (5.0 to 5.2) and weakly alkaline (7.5) regions. The irradiation of liver and thymus chromatin in vitro at doses of 1 to 20 kR does not affect the activity of alkaline RNAase. The activity of acid RNAase of the liver chromatin also is unchanged, while that of the thymus chromatin drops during irradiation, and the effect is intensified with increasing dose. (tr-auth)

22461 (ERDA-tr-31, pp 45-50) TRANSPORT OF ELECTRONS AND PHOTOPHOSPHORYLATION IN CHLOROPLASTS, OXIDATIVE PHOSPHORYLATION IN MITOCHONDRIA OF BUCKWHEAT IN CONNECTION WITH THE GAMMA IRRADIATION OF SEEDS. Guseva, V. A.; Kurganova, L. N.; Gorlanova, T. M. (Gorky State Univ., USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 837-841(1974).

In Radiobiology.

It was established that preplanting irradiation of seeds at a dose of 500 R activates the transfer of electrons of the ETC of photosynthesis of isolated buckwheat chloroplasts during ontogenesis and the photosynthetic phosphorylation coupled with it. Together with an increase in the level of formation of ATP, the content of $NADP{\cdot}H_2$ rises also. An intensification of oxidative phosphorylation and an increase in the P/O coefficient of the mitochondria of irradiated plants were demonstrated. At the same time, an intensification of the ATPase activity of the chloroplasts and mitochondria was detected. (tr-auth)

22462 (ERDA-tr-31, pp 114-117) CORRELATION BETWEEN THE UV-SENSITIVITY OF THE TRYPSIN MOLECULE AND ITS STATE. Kalabukhova, T. N. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 889-891(1974).

In Radiobiology.

The photoinactivation, photochemical, and fluorescent parameters of trypsin were studied within a broad range of pH where the trypsin molecule undergoes a number of transformations. At pH values between 2 and 11, the stability of trypsin to uv inactivation varied according to its phase diagram. (ERB)

22463 (ERDA-tr-31, pp 118-121) CALCULATION OF THE INACTIVATION OF ENZYMES AND BACTERIOPHAGE BY VARIOUS TYPES OF CONTAMINATED PARTICLES. Kerim-Markus, I. B.; Savinskii, A. K.; Filyushkin, I. V.; Chernova, O. N. 1974. Translated from Radiobiologiya; 14: No. 6, 892-894(1974).

In Radiobiology.

Equations for calculating the cross-section of inactivation are given. Calculations are applied to the inactivation of trypsin, beta-galactosidase, and bacteriophage phi X-174 by heavy charged particles. (ERB)

22464 (ERDA-tr-31, pp 129-131) INFLUENCE OF OXIDIZED OLEIC ACID ON THE ENZYMATIC CLEAVAGE OF CASEIN. Ogryzov, N. K.; Gilev, Yu. V. (Perm State Univ., Moscow). 1974. Translated from Radiobiologiya; 14: No. 6, 898-900(1974).

In Radiobiology.

The influence of the products of oxidation of oleic acid on the ability for digestion of casein by trypsin was studied in vitro. It was found that the oleic acid oxidation products substantially inhibited the glycolytic cleavage of casein. Radioprophylactic agents added to the reaction mixture intensified the process. The inhibition phenomenon appeared to be of a competitive nature and was evidently due to adsorption-type phenomena. (ERB)

22465 SYSTEM OF SUPERQUICK REPARATION OF SINGLE RUPTURES INDUCED BY γ IRRADIATION OF DNA OF DIFFERENT STRAINS OF ESCHERICHIA COLI K12. Serna, F. R.; Samoilenko, I. I.; Aizenberg, O. A. (Inst. of Biophysics, Moscow). Dokl. Akad. Nauk SSSR; 221: No. 2, 490-492(11 Mar 1975). (In Russian).

Cultures of E. coli K-12 tagged with ^3H-thymine were washed with 0.01 M sodium phosphate buffer (pH 8.0), and were resuspended in the same buffer. Depending on the purpose of the experiment the bacterial suspension was placed either directly into an ice bath, or first subjected to thermal shock (5 min at 52°C) and then held in an ice bath. Gamma radiation was carried out at 0°C in a ^{60}Co gamma unit at a dose rate of 3 krad/min. Individual ruptures of intracellular DNA were determined. The yield of individual ruptures depended linearly on the dose in the range from 0.5 to 20 krad in the DNA of all three strains, those which were subjected to thermal shock and also those which were not heated. After thermal shocking, the yield of gamma-induced individual ruptures in the DNA increased in all the strains by a factor of 10 to 18. It follows from these data that in these strains there is a very rapid repair of the individual ruptures of the DNA, which can be inactivated by a 5-minute heating of the cells at 52°C. (SJR)

22466 EFFECTS OF IONIZING RADIATION ON HEPATIC PHOSPHOLIPIDS. II. In Vitro Radiation. Garcia Lopez, E. (Univ. de Navarra, Pamplona, Colombia). Rev. Clin. Esp.; 135: No. 2, 147-150(31 Oct 1974). (In Spanish).

The changes induced by in vitro irradiation of liver phospholipids in the rat have been studied. Immediately after treatment only a small effect was observed. The changes appear after the incubation of the samples at 25°C for 20 hours. There was a decrease of phosphatidylcholine and phosphatidylethanolamine and an increase of cardiolipin content. It was not possible to establish correlations between the changes and lipoperoxide presence. The results are discussed. (auth)

22467 EFFECT OF ULTRAVIOLET AND GAMMA RAYS ON THE ACTIVITY OF DELTA-ENDOTOXIN PROTEIN CRYSTALS OF BACILLUS THURINGIENSIS. Burges, H. D.; Hillyer, S.; Chanter, D. O. (Glasshouse Corps Research Inst., Rustington, Eng.). J. Invertebr. Pathol.; 25: No. 1, 5-9(Jan 1975).

Sensitive bioassays with larvae of Pieris brassicae revealed no reduction of insecticidal activity as a result of severe gamma or ultraviolet irradiation of crystals of Bacillus thuringiensis (serotype V). The measured response was the inhibition of larval feeding by the crystals over exposure periods short enough for the presence of live spores not to influence feeding. The results were analyzed using a logistic model. (auth)

22468 INFLUENCE OF VITAMIN A ACETATE, ALCOHOL AND THEIR RADIOLYTIC PRODUCTS ON THE IN VITRO LA-

BILIZATION OF LYSOSOMES AND TISSUE AUTOLYSIS. Ninjoor, V.; Bhushan, B.; Warrier, S. B. K.; Harikumar, P.; Kumta, U. S. (Bhabha Atomic Research Center, Trombay, India). Acta Vitaminol. Enzymol.; 26: 181-188(1972).

A dose dependent release of acid ribonuclease, aryl sulphatase and cathepsin was observed in irradiated lamb liver homogenate. Post-irradiation autolysis of lamb liver resulted in increased release of the lysosomal enzymes concomitant with accumulation of peptides and amino acids, E^{260} absorbing compounds and inorganic phosphate. Addition of fraction F, the radiation degradation products of vitamin A acetate or alcohol induced instantaneous release of acid ribonuclease and cathepsin from lamb liver homogenate. This was accentuated during autolysis at 37°C. Fraction F showed marked lysosome labilizing effect while vitamin A acetate of alcohol showed no response at concentration of 20 μg/ml. (auth)

22469 ESR AND ENDOR STUDIES OF THE PARAMAGNETIC CENTRES IN γ-IRRADIATED SINGLE CRYSTALS OF GLYCYLGLYCINE HYDROCHLORIDE. II. Thermochemical Conversions. Kuropteva, Z. V.; Pulatova, M. K.; Krivenko, V. G.; Kayushin, L. P. (Inst. of Biological Physics, Moscow). Stud. Biophys.; 47: No. 3, 165-182(1974). (In Russian).

It was found by ESR and ENDOR that in gamma-irradiated at 77°K single crystals of glycylglycine hydrochloride the anion radicals of the carboxyl and peptide groups, the decarboxylation radicals, the deamination radicals are formed. Secondary processes including the paramagnetic centres observed result in appearance of radicals $H_3^+NCHCONHCH_2COOH$ and $H_3^+NCH_2CONHCHCOOH$ accompanied by a hydrogen atom loss. Thermo- and photochemical conversions are described for the studied radicals: $-CH_2\dot{C}O^-OH$; $-CH_2\dot{C}O^-NH-$; $-CH_2\dot{C}O$; $H_3^+N\dot{C}H_2$; $-CONH\dot{C}H_2$; $\dot{C}H_2CONH-$; $\dot{N}CH_3$; $H_3^+N\dot{C}HCONH-$; and $-CONH\dot{C}HCOOH$. The hyperfine coupling constants are determined for these radicals. (auth)

22470 gamma-RADIOLYSIS OF ELASTASE. Lynn, K. R.; Skinner, W. J. (National Research Council of Canada, Ottawa). Radiat. Res.; 63: No. 2, 245-252(Aug 1975).

The gamma-radiolysis of elastase caused exponential losses of elastinolytic activity, although losses of esterolytic ability followed nonexponential relations. The nature of the damage to component residues of the enzyme varied depending on the reactive radical species, but trp and tyr were extensively damaged under all circumstances studied. The gross responses to radiolysis of the serine proteases chymotrypsin, trypsin, and elastase are thus seen to be similar. However, elastase exhibits behavior, on radiolysis, which is unique in this group of enzymes. (auth)

22471 OPTICAL PROPERTIES OF GUANINE FROM 2 TO 82 eV. Emerson, L. C.; Williams, M. W.; I'lan Tang, Hamm, R. N.; Arakawa, E. T. (Oak Ridge National Lab., TN). Radiat. Res.; 63: No. 2, 235-244(Aug 1975).

Direct reflectance measurements have been carried out on thin solid guanine films over a range of photon energies extending from 2 to 82 eV. Over this range these measurements, along with a Kramers-Kronig analysis, yield the complex refractive index tilde n, the complex dielectric function tilde epsilon, and the energy loss function -Im(1/tilde epsilon). The structure observed in the dielectric functions is associated with pi yields pi* transitions for energies less than approximately 9 eV and with sigma yields sigma* transitions at higher energies. A pronounced peak in the energy loss function near 25 eV is explained in terms of the collective behavior of the loosely bound electrons. This peak lies at a significantly higher energy than does a corresponding peak calculated from the directly measured energy loss spectrum. Possible reasons for this discrepancy are discussed. (auth)

22472 STABILIZING EFFECT OF ETHYLENEGLYCOL ON DEOXYCYTIDYLATE DEAMINASE IN RELATION TO THERMAL AND ULTRAVIOLET INACTIVATION. Dosseva, I. M.; Tomov, T. H. (Central Brain Research Lab., Sofia). Compt. Rend. Acad. Bulg. Sci.; 28: No. 2, 243-244(1975).

Data are presented to show that ethyleneglycol protects deoxycytidylate deaminase against denaturation factors with altogether different mechanisms of action such as high temperature and uv irradiation. (MCG)

22473 IN VITRO AND IN VIVO EFFECT OF NORMAL AND IRRADIATED PSORALEN ON GLUCOSE OXIDATION OF BRAIN AND LIVER. Ali, R.; Agarwala, S. C. (Aligarh Muslim Univ., India). Enzyme; 18: No. 16, 321-326(1974).

The effect of normal and irradiated psoralen in vitro and in vivo has been studied on glucose oxidation of brain and liver homogenates. Psoralen per se was found to have no effect on in vitro glucose oxidation of brain, while psoralen irradiated for 0.5, 1, 2, 3, and 4 h brought about an inhibition of 29, 34, 37, 43, and 47%, respectively. Psoralen irradiated for 6 h, however, did not give more inhibition. In liver homogenate, psoralen irradiated for 0.5 h brought about an overall inhibition of 10%, which increased to 25, 30, 36, and 43% when psoralen was irradiated for 6 h did not bring further increased inhibition. Feeding of psoralen to albino rats for one week was not found to bring about any change in the glucose oxidation of brain, whereas the oxidation in liver was inhibited to the extent of 23%. The possible significance of these changes in relation to pigment production is discussed. (auth)

Radiation Effects on Cells

22474 EFFECT OF TRITIATED THYMIDINE ON HUMAN CHROMOSOMES. Wang, H. C.; Fedoroff, S. (Univ. of Saskatchewan, Saskatoon). In Vitro; 7: No. 2, 74-79(1971).

The effect of low dosages of ^{3}H-thymidine on human chromosomes was investigated. Two established human cell lines, amnion and HeLa cells, were treated for various periods of time with 0.125, 0.25, 0.50, or 0.75 mu Ci ml of this agent. Chromatid-type aberrations were observed, occurring only if ^{3}H-thymidine was incorporated into DNA during the S phase of the cell cycle. The higher the dosage and the longer the ^{3}H-thymidine acted on chromatin, the greater the number of aberrations induced. Chromosomes were most sensitive to the effects of ^{3}H-thymidine during the early S phase of the cell cycle. (auth)

22475 NEW METHOD FOR MAPPING GENES IN HUMAN CHROMOSOMES. Goss, S. J.; Harris, H. (Oxford Univ.). Nature (London).; 255: No. 5511, 680-684(26 Jun 1975).

It is stated that if human cells are subjected to large doses of ionizing radiation and then fused with rodent cells, hybrid clones are obtained in which linked human genes may be segregated. By measuring the frequency with which pairs of linked genes are cotransferred after irradiation, it is possible to determine the linear order of groups of genes and to estimate the distances between them. This technique offers a new and systematic approach to the mapping problem. (auth)

22476 RADIATION-INDUCED DNA STRAND BREAKS IN E. COLI MEASURED WITHIN A FRACTION OF A SECOND. Johansen, I. (Univ. of Oslo); Boye, E. Nature (London).; 255: No. 5511, 740-742(26 Jun 1975).

It is known that the yield of radiation induced strand breaks in DNA is normally larger in oxygenated cells than in anoxic cells. This may indicate radiation chemical reactions or preferential repair of breaks formed under anoxic conditions. It is possible to distinguish between these possibilities by experiments in which irradiation and cell lysis are completed within a time short enough to minimize repair. Measurements are reported on chromosomal DNA in E. coli with irradiation and lysis carried out within a fraction of a second. The results indicated that there may have been some misinterpretation of experiments on the oxygen effect and that radiation chemical reactions involving sulphydryl compounds may be the dominant factor. (UK)

22477 ELECTRON MICROSCOPY 1974. Volume II. Biological. Proceedings of the Eighth International Congress on Electron Microscopy Held in Canberra, Australia, 25-31 August 1974. Sanders, J. V.; Goodchild, D. J. (eds.). Canberra, Australia; The Australian Academy of Science (1974). 759p. (In several languages). (CONF-740853-P2).

From 8th international congress on electron microscopy; Canberra, Australia (25 Aug 1974).

Abstracts of papers presented to the 8th international congress on electron microscopy are presented in these proceedings. Among the general categories under which the papers were presented are included: stereology; cryotechniques; x-ray microanalysis in biology; immuno-techniques; cytochemistry; specimen preparation; membranes (structure and interrelationships); membranes (cellular interaction and recognition); eukaryotic chromosomes; nucleus cell division; nervous system; nervous tissue; intracellular filaments; cytoplasmic organelles; muscle; blood cells and vessels; organs; pathology lower plants and fungi; plant cells; viruses; bacteria and microorganisms; SEM applications (freeze-etch); radiation damage (biological); and collagen, cartilage, and skin. (ERB)

22478 MODIFICATION OF RADIATION EFFECTS ON CELLS BY MEMBRANE BINDING AGENTS: PROCAINE HC1. George, K. C.; Shenoy, M. A.; Joshi, D. S.; Bhatt, B. Y.; Singh, B. B.; Gopal-Ayengar, A. R. (Bhabha Atomic Research Centre, Bombay). Br. J. Radiol.; 48: No. 571, 611-614(Jul 1975).

The mechanism of the radiosensitizing action of procaine HC1 was studied for bacterial and mammalian cells in vitro. Under anoxic conditions of irradiation, E. coli B/r cells, Yoshida ascites tumor cells, and rat thymocytes were sensitized to ^{60}Co γ rays by 25 mM procaine HC1; the addition of procaine HC1 to irradiated cells within a minute after irradiation produced 60 to 70% of the total sensitizing action. No sensitizing effects were observed when

the irradiations were carried out in air. These results were consistent with the involvement of the lipid milieu of the cell membrane in the radiosensitizing effects of both procaine HC1 and oxygen. Procaine HC1 did not sensitize E.coli B/r to ultraviolet radiation, also indicating that the sensitizing effects of procaine HC1 are the result of damage to some other cellular organelle rather than a direct enhancement of DNA damage. Any interaction of procaine HC1 with damaged cell membrane would modify the cellular lethality by interfering with the biochemistry of DNA, including the repair of DNA damage, known to be associated with the cell membrane. Procaine HC1 (1 mM) was also found to enhance radiation induced chromosome aberrations in Chinese hamster cells under anoxic conditions of x irradiation (150 R and 300 R), although a decrease in the percentage of damaged cells was observed at a dose of 300 R compared with 150 R. (UK)

22479 ADVANCES IN RADIATION BIOLOGY. Volume 4. Lett, J. T.; Adler, H.; Zelle, M. (eds.). New York; Academic Press (1974). 435p.

The book is the fourth volume of a serial publication. Separate abstracts were prepared on the seven chapters. (CH)

For abstracts of individual chapters see: 22480, 22481, 22500, 22512, 22608, 22609, and 22658.

22480 REPAIR PROCESSES FOR PHOTOCHEMICAL DAMAGE IN MAMMALIAN CELLS. Cleaver, J. E. (Univ. of California, San Francisco). Adv. Radiat. Biol.; 4: 1-75(1974).

Repair processes for photochemical damage in cells following uv irradiation are reviewed. Cultured fibroblast cells from human patients with xeroderma pigmentosum were used as an example to illustrate aspects of repair of injuries to DNA and proteins. (250 references) (CH)

22481 BREAKAGE-AND-REUNION THEORY AND THE EXCHANGE THEORY FOR CHROMOSOMAL ABERRATIONS INDUCED BY IONIZING RADIATIONS: A SHORT HISTORY. Revell, S. H. (Inst. of Cancer Research, London). Adv. Radiat. Biol.; 4: 367-416(1974).

Data are reviewed from a number of studies on radioinduced chromosomal aberrations in proliferating mammalian cells, with emphasis on the mechanics of chromosomal aberrations. Present theories of how we should interpret the changes in chromosome structure that are seen at mitosis after cells have been exposed to ionizing radiations are discussed. (80 references) (CH)

22482 INFLUENCE OF DETERGENTS ON HEp-2 CELLS IN DEPENDENCE ON X IRRADIATION. Gayer, J.; Pribys, R. (Karlova Univ., Hradec Kralove, Czech.). Sb. Ved. Pr. Lek. Fak, Karlovy Univ. Hradci Kralove.; 16: No. 3, 105-110(1973).

HEp-2 cells in a chamber allowing photomicrography were treated by neutral, anionic, and cationic detergents. Their damages under concentrations 1 mg/ml, and 100 ug/ml were observed, and described as varying with respect to the drug. The control 500 R irradiation of untreated cells had not any apparent effect on their morphology. However, the 500 R pre-irradiation strongly modified their reactions. A synergistic role of pre-irradiation was observed for Tego-Betain, and Tween 40, the antagonism for Sandopan, and SV-133. (auth)

22483 X-RAY DOSE DEPENDENCE OF GAP FORMATION IN THE NEWLY SYNTHESIZED DNA OF CHINESE HAMSTER V79/4 CELLS. Koerner, I.; Malz, W.; Guenther, K. (Central Inst. of Molecular Biology, Berlin). Stud. Biophys.; 47: No. 2, 127-132(1974).

After x-irradiation of Chinese hamster V79/4 cells the newly synthesized daughter strands of the DNA, examined by pulse-labelling with the alkaline sucrose gradient technique, show gaps and subsequent gap filling (post-replication repair), which was reported in an earlier publication for 500 rads. In this paper, a linear dependence of the number of gaps per molecular weight unit on dose is proved, resulting in the figure of $6.6 \cdot 10^{-12}$ gaps per rad and Dalton. It is pointed out that the primary radiation-induced lesions responsible for the gap formation in the opposite daughter strands are likely to be base damages. (auth)

22484 BIOLOGICAL DETERMINATION OF THE VARIATION OF FAST-NEUTRON FIELD QUALITY WITH DEPTH, RBE, AND OER. Zeitz, L.; Canada, T. R.; Djordjevic, B.; Dymbort, G.; Freeman, R.; McDonald, J. C.; O'Neil, J.; Laughlin, J. S. (Sloan-Kettering Cancer Center, New York). Radiat. Res.; 63: No. 2, 211-225(Aug 1975).

The biological effectiveness of two cyclotron-produced fast neutron fields ($\bar{E}$/sub n/ approximately 3.5 and 7 MeV) has been studied as a function of depth within a water phantom. Aerobic and hypoxic HeLa S3 cell survival data were obtained at depths of 2 and 12 cm and compared with those measured in a ^{60}Co gamma ray field. Although the resulting survival curves show a small decrease in sensitivity with increasing depth, the oxygen enhancement ratio remains constant and has a value of 1.8 +- 0.1 in both fields. (auth)

22485 INTERACTION BETWEEN RADIATION AND DRUG DAMAGE IN MAMMALIAN CELLS. I. Delayed Expression of Actinomycin D/X-Ray Effects in Exponential and Plateau Phase Cells. Piro, A. J.; Taylor, C. C.; Belli, J. A. (Harvard Medical School, Boston). Radiat. Res.; 63: No. 2, 346-362(Aug 1975).

The survival characteristics of V79 Chinese hamster cells exposed to either x radiation or actinomycin-D and subsequently treated with the other modality were studied. Exponentially growing cells were exposed to either 820 R, 50 kVp x rays or 3.0 mu g/ml AMD for 30 min and the survivors were exposed to graded doses of the other agent 2, 3, and 7 days afterward. The previously irradiated cells did not differ in their response to subsequent AMD, whereas the cells which had survived AMD demonstrated a decrease in extrapolation number and tilde D/sub Q/ when exposed to x rays as compared to cells not previously treated with AMD. The x-ray two-dose response was studied in cells exposed to 3.0 mu g/ml 3 days before. The AMD treated cells had a lower maximum recovery ratio than controls and subsequent survival with time between doses was lower than in controls. Similar experiments were done with stationary (plateau phase) V79 cells. The response of stationary cells to AMD after either similar doses (820 R) or fractionated doses (210 R for 5 days) of radiation was seen to be a function of time between the last x-ray exposure and the time of exposure to AMD. X-irradiated stationary phase cells appeared to be more sensitive to AMD at 3 days following x radiation, but not at 7 days. The x-ray survival curves of stationary cells treated with AMD 2, 3, and 7 days before were noted to have lower extrapolation numbers and tilde D/sub Q/'s than the same age stationary cells not exposed to AMD. However, two-dose recovery in plateau cells was not affected by exposure to AMD 3 days before. (auth)

22486 CHANGES IN RADIOSENSITIVITY OF V-79 CELLS ACCOMPANYING GROWTH AND CELL DIVISION. Lehnert, S. (Columbia Univ., New York). Radiat. Res.; 63: No. 2, 326-335(Aug 1975).

The X-ray survival curve for asynchronous Chinese hamster V-79 cells at 17 to 20 hr after plating when cells are irradiated as microclones of two to four cells differs from the survival curve seen at short times after plating, when single cells are irradiated, in having higher D_0 (300 rad vs 160 rad) and negligible extrapolation number. As a consequence of the difference in D_0 the difference in survival between single cells and clones increases with increasing dose. Transient cyclic changes in survival occur at early times after plating and are probably related to partial synchronization induced by trypsinization. In addition there is a progressive increase in survival which develops with increasing time after plating, as the number of cells in the clones increases. Decrease in radiosensitivity with increasing number of cells irradiated is also observed for synchronous cells when cells at corresponding points in the cell cycle are irradiated. Accumulation and repair of sublethal damage is demonstrable in cells irradiated at short times after plating, but cannot be shown at 20 hr after plating when cells are irradiated as microclones. (auth)

22487 ENHANCING EFFECT OF MITOGENS ON THE IN VIVO IMMUNE RESPONSE OF RABBITS. Romball, C. G.; Weigle, W. O. (Scripps Clinic and Research Foundation, La Jolla, CA). J. Immunol; 115: No. 2, 556-560(Aug 1975).

The effect of Con A and PHA on the primary humoral immune response in rabbits was investigated and compared with the effect of LPS and irradiation. Both Con A and PHA enhanced PFC levels and precipitating antibody titers to HuIgG when injected simultaneously with AHuIgG. Comparable enhancement of the response to HuIgG was obtained by simultaneous injection of LPS with AHuIgG or by irradiating rabbits (500 R) 24 hr after injection of the antigen. Further studies with Con A showed that its adjuvant effect was not restricted to a particular antigen since it also enhanced antibody responses to both SRBC and Bov Tg when injected simultaneously with either of these antigens. Although optimal enhancement of the response to HuIgG occurred when antigen and mitogen were injected simultaneously, some enhancement was obtained if Con A was injected 2 days after antigen, whereas the response was decreased if Con A was injected 2 days before antigen. Splenic PFC in A/J mice injected with doses of AHuIgG and Con A equivalent on a body weight basis to those used in rabbits were also enhanced by simultaneous injection of Con A with the antigen. (auth)

22488 RADIORESISTANCE OF CELLS RESPONSIBLE FOR DELAYED HYPERSENSITIVITY REACTIONS IN THE MOUSE. Kettman, J.; Mathews, M. C. (Univ. of Texas, Dallas). J. Immunol.; 115: No. 2, 606-608(Aug 1975).

The cells responsible for delayed hypersensitivity reactivity in the mouse act in a radioresistant fashion only if such irradiated cells are injected directly into the site of antigen challenge. Intravenous transfer of irradiated, primed spleen cells does not achieve a transfer of sensitivity to show delayed type hypersensitivity reactions. Transfer of sensitivity by the intravenous route can be effected by injection of non-irradiated spleen cells from primed mice. (auth)

22489 T CELL ACTIVATION AND CELLULAR COOPERATION IN AUTOIMMUNE NZB/NZW F_1 HYBRID MICE. Roder, J. C.; Bell, D. A.; Singhal, S. K. (Univ. of Western Ontario, London). J. Immunol.; 115: No. 2, 466-472(Aug 1975).

Old (6 months) overtly autoimmune female NZB x NZW F_1 (B/W) mice were markedly hyporesponsive to sheep erythrocytes (SRBC). The response to SRBC was restored by (a) simultaneously injecting lipopolysaccharide (LPS) with SRBC or (b) transferring bone marrow and thymocytes with SRBC into lethally x-irradiated (1000 R) syngeneic old recipients. The in vitro PFC response of old B/W spleen cells to SRBC was restored by adding in culture (a) theta-positive and radioresistant spleen cells from old B/W mice primed with homologous antigen or (b) activated T cells from the spleens of lethally x-irradiated (1000 R) old B/W mice injected with old syngeneic thymocytes and SRBC but not horse erythrocytes. Various populations of unprimed lymphoid cells from young (4 to 6 weeks) female B/W mice, which respond normally to SRBC, were not capable of restoring the response of old syngeneic mice in vitro or in vivo. These results suggest the existence of a suppressor of T cell activation and/or B and T cell interaction in old autoimmune B/W mice. (auth)

22490 EXAMINATIONS OF THE SIMULTANEOUS EFFECT OF 5-BROMO-DESOXY-URIDINE AND CYSTEAMINE UPON X-IRRADIATED DIPLOID CELLS OF THE CHINESE HAMSTER, CRICETULUS GRISEUS, IN VITRO. Miltenburger, H. G.; Bauer, A. (Technische Univ. Darmstadt (F. R. Germany). Fachgebiet Zoologie). Strahlentherapie; 149: No. 4, 406-416(Apr 1975). (In German).

Cells of the Chinese hamster cell line B 14 FAF 28 were treated with BUdR and irradiated with X-rays in the presence of cysteamine. The dose-dependent inactivation rates could be determined rather precisely by marking single cells. Daily cell counts in the growing colonies made it possible to establish individual colony growth curves. The results of both analyses show for untreated and treated cells a nearly equal factor with respect to the protecting effect of cysteamine. Also in the macrocolonies this effect is clearly measurable even five days after irradiation indicating a still existing very different vitality of the cells at that time. The results are discussed with respect to following irradiations. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 22458, 22463, 22467, 22478, 22479, 22574, and 22602.

22491 (ERDA-tr-31, pp 137-140) INVESTIGATION OF THE PENETRATION OF MEXAMINE INTO CELLS OF E. COLI. Noskin, L. A.; Stepanova, I. M.; Sverdlov, A. G. (Leningrad Inst. of Nuclear Physics). 1974. Translated from Radiobiologiya; 14: No. 6, 905-907(1974).

In Radiobiology.

The penetration of mexamine into cells of Escherichia coli was investigated in order to elucidate the mechanism of penetration of mexamine into cells. The data indicate that mexamine is accumulated by the cells. Dilution data entirely exclude diffusion kinetics as the mechanism. On the basis of data obtained from chloroamphenicol-treated cells, it is possible to postulate the active transport of mexamine within the cell. Although sorption on the cell cannot be ruled out, the conclusion of the penetration of mexamine into the cell is in good agreement with data from radiation survival studies. (ERB)

22492 (JEN-296) GAMMA RADIATION EFFECT ON THE SPROUTING OF POTATO TUBER BUDS (SOLANUM TUBEROSUM L.) AND DEVELOPMENT OF A BIOLOGICAL TEST TO IDENTIFY THE IRRADIATED TUBERS. Fernandez Gonzalez, J.; Garcia Collantes, M. A. (Junta de Energia Nuclear, Madrid (Spain)). 1975. 66p. (In Spanish). Dep. NTIS (US Sales Only) $6.50.

The effect of the ^{60}Co γ radiation on the development of potato sprouts was studied, at doses of 3, 6, 9, and 12 krad. Studies on the culture, in sprouts were carried out grafting over parenchyma and artificial culture, in order to study the direct and the indirect effect. A bioassay method was established in order to distinguish the radioinhibited tubers from those inhibited by chemical agents or by refrigeration. (auth)

22493 (NP-20444, pp 82-85) MOLECULAR GENETICS. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

22494 IRRADIATED ALLOGENEIC BONE GRAFTS IN THE TREATMENT OF ODONTOGENIC CYSTS. Spengos, M. N. (Evangelismos Medical Center, Athens). J. Oral Surg.; 32: No. 9, 674-678(Sep 1974).

Irradiated allogeneic bone grafts used in the treatment of odontogenic cysts were successful in 73.4 percent of 30 patients. Results were judged on the basis of clinical and radiographic evaluations as long as two years after the operations. Technical factors and secondary infection rather than rejection were considered as causes of failure in the remainder of the patients. (auth)

22495 EFFECT OF IONIZING RADIATION ON THE ANTIBIOTIC SENSITIVITY OF MICROCOCCUS RADIODURANS STRAINS R_I AND $R_{II}5$. Agha, N.; Salih, F. M.; Auda, H.; Al-Barwari, S. (Iraq Atomic Energy Commission, Baghdad). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 387-391(Jun 1975).

Micrococcus radiodurans strains R_I and $R_{II}5$ were tested for susceptibility to several antibiotics by the standardized Bauer-Kirby disc diffusion and tube dilution techniques, using different size of inoculum irradiated at doses of 150, 300, 500, and 750 krad; and control without irradiation. The size of inoculum had a variable effect on susceptibility, depending on the strain of M radiodurans, the antibiotics, and the dose of irradiation. In general, strain R_I was more sensitive to the antibiotics and the radiation than $R_{II}5$. The minimal inhibitory concentration and the minimal bactericidal concentration of the antibiotics against M radiodurans were determined. (auth)

22496 SURVIVAL AFTER GAMMA AND ULTRAVIOLET IRRADIATION IN DIFFERENT STRAINS OF ESCHERICHIA COLI K12. Chiarini, A. (Univ. of Palermo, Italy); Natoli, D.; Sinatra, A.; Calderaro, E.; Castiglia, F.; Oliveri, E. G. Batteriol., Virol., Immunol. Ann. Osp Maria Vittoria Torino; 67: No. 1-6, 41-51(1974).

In trials involving five mutant strains of E. coli K12, one of the strains (E.coli K12 Hfr) showed a greater sensitivity, expressed as inactivation rate, occurring after both gamma and uv irradiations. Indirect evidence, in the sensitive strain, for a lower repair capacity was obtained by examining the effects of the incubation in saline on the microorganisms viability as well as by analyzing the growth curves of irradiated bacteria. (auth)

22497 STERILIZATION WITH IONIZING RADIATION OF ARTICLES FOR MEDICAL USE MADE OF POLYMERIC MATERIALS. Ramkova, N. V.; Potapenko, T. L.; Vyshegorodskaya, R. A.; Nesterova, L. I. Zh. Mikrobiol., Epidemiol. Immunobiol.; 8: 53-56(Aug 1974). (In Russian).

The authors elaborated a regimen of sterilization with gamma rays of some articles for medical use made of rubber and plastic materials (made in the USSR) with consideration to natural contamination and under conditions of artificial infection with test-microorganisms. Physico-mechanical properties of these materials after sterilization were investigated; periods during which the articles packed in polyethylene remained sterile after sterilization with gamma rays were studied. (auth)

22498 THE POSSIBILITIES FOR APPLICATION OF THE CANINE HOOKWORM VACCINE TECHNOLOGY TO THE PREVENTION AND CONTROL OF HOOKWORM INFECTION AND DISEASE IN MAN. Miller, T. A. (Jensen-Salsbery Laboratories, Kansas City, Kansas (USA). Div. of Richardson-Merrell Inc.,). pp 61-68 of Nuclear Techniques in Helminthology Research. Proceedings of a Panel on the Use of Nuclear Techniques in Research and Control of Helminthic Infections Organized by the IAEA and WHO and Held in Nairobi, 26-30 November 1973. Vienna; IAEA (1975).

From panel on the use of nuclear techniques in research and control of helminthic infections; Nairobi, Kenya (26 Nov 1973).

22499 EFFECT OF GAMMA RADIATION ON PHYSICO-CHEMICAL CHARACTERISTICS OF RED GRAM (CAJANUS CAJAN) STARCH. Nene, S. P.; Vakil, U. K.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). J. Food Sci.; 40: No. 5, 943-947(1975).

Total reducing and nonreducing sugars in red gram (Cajanus cajan) are not affected by radiation treatment (1 Mrad). Oligosaccharides, reported as flatulence factors in legumes, namely stachyose and raffinose, are slightly decreased on cooking the irradiated samples. Irradiated and cooked red gram starch is more susceptible to alpha-amylase action than the unirradiated sample. Rheological properties of red gram starch, such as gelatinization viscosity, swelling power and solubility improve on irradiation resulting in a final cooked product with better textural properties. (auth)

22500 ENZYMES INVOLVED IN THE REPAIR OF DNA. Grossman, L. (Brandeis Univ., Waltham, MA). Adv. Radiat. Biol.; 4: 77-129(1974).

The relationship of a nuclease-mediated process for the excision of pyrimidine dimers from DNA in bacteria following exposure to ultraviolet radiation to enzymatic processes associated with replication and recombination is discussed. Techniques and methods for assay enzymes in such a mechanism are described. A proposed pathway for excision repair in micrococcus luteus is presented that involves nucleases, ligases, and polymerases. (150 references) (CH)

22501 VITAMIN B_{12} CONTENT OF HEPASON SUBJECTED TO RADIOSTERILIZATION. Wozniak-Parnowska, W.; Szepietowska, B. Acta Pol. Pharm.; 31: No. 6, 805-819(1974). (In Polish).

Doses of 1.5 to 2.5 Mrad of gamma radiation were found to be sufficient for sterilization of stock preparations of Hepason. Thus, Hepason has turned out to be sterilized by lower doses of radiation than other biological materials. No changes in vitamin B_{12} content were found in the preparations subjected to radiosterilization, which testifies their biological value. (auth)

22502 INNOCUOUSNESS OF POTATOES IRRADIATED BY A STREAM OF FAST ELECTRONS AND GAMMA RAYS TO DEFER SPROUTING. Shillinger, Yu. I.; Kamaldinova, Z. M. (Supply Institute, Moscow). Vop. Pitan.; 6: 50-55(1973). (In Russian).

The effect on the organism of albino rats of their feeding on irradiated potatoes was studied. Subjects to investigation were possible toxic properties of potatoes irradiated by a stream of fast electrons (30 kilorads), its influence upon the reproducing function and progeny. The potential mutagenic action of potatoes irradiated by gamma rays and by a stream of fast electrons was determined by the method of dominant lethal mutations. Upon treating potatoes with low doses of ionizing radiation, to defer sprouting, no substances exerting toxic or mutagenic action on the organism of test animals were found to be contained therein. (auth)

22503 USE OF ANTINUCLEOSIDE ANTIBODIES TO PROBE THE ORGANIZATION OF CHROMOSOMES DENATURED BY ULTRAVIOLET IRRADIATION. Schreck, R. R.; Erlanger, B. F.; Miller, O. J. (Columbia Univ., New York). Exp. Cell Res.; 88: No. 1, 31-39(Sep 1974).

Ultraviolet irradiation of methanol : acetic acid-fixed human and mouse metaphase chromosomes rendered them capable of binding antibodies specific for purine or pyrimidine bases. Since these antibodies react with single-stranded but not with native DNA, our results indicate that UV irradiation generated single-stranded regions in chromosomal DNA. Using an indirect immunofluorescence technique to detect antibody binding, highly characteristic, nonrandom patterns of antibody binding were observed. Antibodies to adenosine (anti-A) and thymidine (anti-T) produced identical patterns of binding which in most respects matched the chromosome banding patterns produced by quinacrine. However, additional foci of intense fluorescence were seen in the paracentromeric regions of constitutive heterochromatin on chromosomes 1, 9 and 16, regions which had been shown by in situ DNA–RNA hybridization to be the locations of AT-rich human satellite DNA. Antibodies to cytidine were also bound to the same region of chromosome 9. In mouse chromosome preparations, both anti-A and anti-T produced bright fluorescence of the region containing centromeric heterochromatin, which had been shown to be the location of the AT-rich satellite DNA of this species. (auth)

22504 ULTRAVIOLET CARCINOGENESIS. Rosen, P. (Oak Ridge National Lab., TN). Int. J. Quant. Chem. 9: No. 3, 473-478 (May 1975).

A theory of uv carcinogenesis is described in which damage to DNA in the form of pyrimidine dimers occurs in a critical operator region of the genome that controls the synthesis of divisional proteins. There is a chance that a mutation will occur in the region of the operator either during replication or during postreplication repair, so that unchecked growth will be passed on to daughter cells. Comparison with the experiments of Hart and Setlow (1973) indicates that agreement is semiquantitative. (auth)

22505 RADIOSENSITIVITY OF CONTINUOUS CULTURES: EXPERIMENTS WITH DIPLOID YEAST. Kiefer, J.; Wagner, E. (Strahlenzentrum der Justus Liebig-Universitat, Leihgesterner, Ger.). Radiat. Res.; 63: No. 2, 336-345(Aug 1975).

To study the influence of systems parameters on the radiosensitivity of cell populations, stationary chemostat cultures of diploid yeast with different dilution rates were gamma-irradiated. Proliferation and budding kinetics were investigated and the doses necessary to eliminate the entire population determined as a function of dilution rate. It was found that this killing dose decreases with dilution rate in a linear manner. The radiosensitivity of the cells was shown to depend on the dilution rate which is presumably due to differing compositions of the population. (auth)

22506 STUDY OF THE INFLUENCE OF SELECTIVE MEDIA ON THE EXPRESSION OF UV-INDUCED ARG$^+$ REVERSIONS IN THE H/r 30 R E. COLI STRAIN. Slamenova, D.; Cao Thi Loi. (Cancer Research Inst., Bratislava). Stud. Biophys.; 48: No. 1, 19-26(1975).

The ratio of suppressor and non-suppressor Arg$^+$ reversions was studied in uv-irradiated H/r 30 R E.coli cells in dependence on the composition of selective media and the dose of radiation. We confirmed that selective media containing broth stimulated to a great extent the expression of suppressor and to a smaller extent the expression of non-suppressor mutations, this effect being, however, only produced within a certain dose range of uv radiation. The significance of a selective medium when expressing revertants in an irradiated suspension was verified by following restoration of DNA synthesis and cell division when cultivating irradiated cells on two types of selective media. Our results suggest that the increased level of Arg$^+$ reversions observed on plates containing broth is due to defective repair of uv -caused damage stimulated when cultivating irradiated cells on this type of medium. (auth)

22507 PROTECTIVE EFFECT OF CAFFEINE AGAINST UV-INACTIVATION OF BACTERIOPHAGES. Meyer, M.; Witte, W. (Martin-Luther Univ., Halle, Ger.). Stud. Biophys.; 48: No. 1, 43-50(1975). (In German).

A protective effect of caffeine against uv-inactivation of bacteriophages. In this paper a protective effect of caffeine against uv-inactivation of bacteriophages VIr of Proteus mirabilis and T7 of Escherichia coli is described. We explain our results by a high physical and a low biological effect. This effect is dependent on the concentration of caffeine. (auth)

22508 EFFECTS OF THREE RAD GENES ON UV INDUCED MUTATION RATES IN HAPLOID AND DIPLOID SACCHAROMYCES CELLS. Eckardt, F.; Kowalski, S.; Laskowski, W. (Freie Univ. Berlin (F.R. Germany). Zentralinstitut fuer Biochemie und Biophysik). Mol. Gen. Genet.; 136: No. 3, 261-272(Apr 1975).

Effects of the rad 2-20, rad 9-4, r_1^+, and the corresponding wild type RAD alleles in haploid and homozygous diploid Saccharomyces strains on UV induced mutation rates from adenine, lysine, and histidine dependence to independence are reported. The UV induced mutation rates were similar for the RAD, r_1^+, and rad 9-4 haploids, whereas the rad 2-20 mutation causes a marked increase in the UV induced mutation rates. The diploid rad 2-20 strain also exhibits a marked increase in the UV induced rates, whereas the rad 9-4 diploid has reduced mutation rates when compared to the wild type. The UV induced mutation rates of haploid and diploid RAD strains are almost identical. For the rad 2-20 and rad 9-4 diploids, however, these rates are smaller than in the corresponding haploid strains. Differential effects of the rad genes on the ratio of locus to suppressor mutations were found. The implications of these findings on possible repair processes in yeasts are discussed. (auth)

Radiation Effects on Plants

Refer also to abstracts 22461, 22492, and 22574.

22509 (CONF-7404111-(Absts)) SYMPOSIUM ON USE OF RADIATIONS AND RADIOISOTOPES IN STUDIES OF PLANT PRODUCTIVITY, PANTNAGAR, INDIA, APRIL 12–14, 1974. Programme and Abstracts. (Department of Atomic Energy, Bombay (India). Food and Agriculture Committee). 1974. 161p.

Abstracts of papers given at the symposium are presented. The papers discussed specific subjects in the following general areas: induced mutations for the improvement of cereals, millets, legumes, oilseeds, tobacco, fiber crops, vegetatively propagated crops, and ornamentals; nuclear techniques in plant breeding; radiation induced growth stimulation; soil chemistry; soil moisture, irrigation, and water use efficiency; ion uptake and translocation; fertilizer usage; root distribution in relation to nutrient uptake; plant metabolism, photosynthesis; microbiology; plant pathology; metabolism and degradation of pesticides; and sterility approach for insect pest control. (ERB)

22510 (ERDA-tr-31, pp 86-93) BIOLOGICAL EFFECT OF GAMMA IRRADIATION ON SEEDS OF ARABIDOPIS THALIANA (L.) HEYNH. AS A FUNCTION OF THE RADIATION INTENSITY. Kartel, N. A.; Maneshina, T. V. (Inst. of Genetics and Cytology, Minsk). 1974. Translated from Radiobiologiya; 14: No. 6, 869-874(1974).

In Radiobiology.

The survival and fertility of plants of Arabidopsis thaliana (L.) Heynh. vary sharply depending on the radiation intensity in the case of irradiation of dry seeds at doses from 10 to 140 kR. At relatively low doses of gamma irradiation (10 to 40 kR), a radiation intensity 20 kR/min is substantially more effective than 2 kR/min. In the case of irradiation at doses of 100, 120, and 140 kR, an opposite effect of the time factor appears. The bio-

logical effects of the radiation intensity obtained have an effect on processes of repair and repopulation recovery. (tr-auth)

22511 EFFECTS OF IONIZING RADIATION ON ROSES: MEIOTIC STUDIES ON CONTROL AND GAMMA RAY INDUCED MUTANTS OF ROSE CULTIVAR MONTEZUMA. Lata, P.; Gupta, M. N. (Radiation Biology Lab., Lucknow, India). Cytologia (Tokyo); 40: 213-219(1975).

Rose cultivar Montezuma and two of its gamma ray induced mutants presented a marked distinction in their cytological features. Their male meiosis revealed a great variation with regard to chromosome associations at metaphase I which comprised of univalents, bivalents, trivalents and quadrivalents. Ring shaped quadrivalents were more common than the chains. The frequency of quadrivalents was enhanced in mutant plants. The percentage of PMCs with precocious separation, laggards and bridges at anaphases was found to be higher in mutants as compared with the control plants. These results indicate that chromosomal structural changes might also be responsible for the induction of these mutations. The pollen fertility decreased in Pink flowered mutant as compared with control, whereas, an increase was recorded in Reddish-orange flowered mutant. The nature of above mentioned variations in gamma induced mutants may be chromosomal/gehic or both. (auth)

22512 EFFECTS OF IONIZING RADIATION ON TERRESTRIAL PLANT COMMUNITIES. Whicker, F. W.; Fraley, L. Jr. (Colorado State Univ., Fort Collins). Adv. Radiat. Biol.; 4: 317-366 (1974).

Data are reviewed from several studies on the effects of ionizing radiation on terrestrial plant communities. Results of studies on forests, grasslands, and other herbaceous or shrub-dominated communities in North America exposed for various periods of time to gamma sources or mixed beta-gamma fallout simulant are discussed. (140 references) (CH)

22513 RADIOBIOLOGIYA I GENETIKA ARABIDOPSISA. (Radiobiology and Genetics of Arabidopsis). Ivanov, V. I. Problemy Kosmicheskoi Biologii. Tom 27. Moscow; Izdatel'stvo Nauka (1974). 191p.

The general characteristics of Arabidopsis, of the Cruciferae family, are presented; this is a new and promising object for studies in radiobiology, genetics, and space biology. Laboratory techniques, including methods for cultivating these plants and for demonstrating and quantitatively measuring mutants, are discussed. A method has been developed for establishing a relation between the recorded indexes of an induced mutation process and the number of mutants originating in embryonic meristem cells. Somatic and genetic effects of irradiation and the effects of the physiological state of the seeds, post-irradiation storage, thermal shock, and radiation linear energy loss are considered. The relation between different manifestations of radiation damage to plants is discussed. 650 references. (tr-auth)

22514 ADAPTION AND EVOLUTION PROCESS IN IRRADIATED SYNTHETIC POPULATION OF ARABIDOPSIS THALIANA. III. Change of Variability of Quantitative Characters in M_2-M_6. Dislers, V.; Rasals, I. (Inst. of Biology, Riga). Latv. PSR Zinat. Akad. Vestis; No. 5, 24-31(1975). (In Russian).

Irradiation causes an increased genotypical variability in the populations of Arbidopsis thaliana in M_2 according to the number of internodes, but not to the plant height. The variability induced by irradiation and that caused by a mixture of different races of plants A. thaliana at M_5-M_7 generations was considerably decreased because of a stabilizing natural selection. The mixture itself determines a special class of variability caused by different intrapopulation competitive abilities of plants. The manifestation of this variability was greatest in M_3-M_4 and may be the cause of non-resultative artificial selection. Repeated irradiation increases the variability of quantitative characters in a number of cases but the main effect was the increased intensity of stabilizing selection. (auth)

22515 CHROMATOGRAPHY OF FREE AMINO ACIDS FROM EMBRYOS OF WINTER WHEAT CULTIVARS DIFFERING IN RADIOSENSITIVITY. Faehnrich, P. (Kernforschungsanlage, Juelich, Ger.). Stud. Biophys.; 48: No. 1, 27-32(1975). (In German).

Embryos of the radioresistant cultivar Bayro and of the radiosensitive cultivar Walthari contained the same amino acids. No or only slight differences existed in the amino acid amount in these cultivars. There was no correlation between radiosensitivity and amino acid content. (auth)

Radiation Effects on Animals

22516 EFFECTS OF RADIOTHERAPY ON THE NASOLACRIMAL SYSTEM AS EVALUATED BY DACRYOSCINTIGRAPHY. Brizel, H. E.; Sheils, W. C.; Brown, M. (Medical Coll. of Georgia, Augusta). Radiology; 116: No. 2, 373-381(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

By utilizing 61 lacrimal scans, 26 patients who had received radiotherapy for inner canthus and lid lesions were evaluated. Results indicate that the membranous lacrimal passages are relatively immune to radiation therapy. Although dacryoscintigraphy did not delineate the anatomical features quite as well as contrast dacryocystography, it yielded very useful information about flow mechanisms and tear transit times. The study is rapid, simple, non-hazardous, and particularly helpful in documenting the status of the lacrimal drainage system before and after radiotherapy to the inner canthus region. (auth)

Man

Refer also to abstracts 22315, 22636, 22696, and 23011.

22517 (COO-2536-1) STUDY OF RADIATION DOSE FROM RADIOACTIVE SHIPMENTS TO CARGO HANDLERS AT O'HARE FIELD. (Northwestern Univ., Evanston, Ill. (USA)). Jun 1975. 40p. Dep. NTIS $5.00.

The relationship between the amount of radioactive materials that pass through the cargo areas at O'Hare Field, Chicago, and the resulting radiation dose to the workers handling the packages was determined. Measurements of radiation exposure rates at various distances from the radioactive packages were made. Handling or exposure times for personnel during several unit operations were measured with a watch. These data were used to determine the body dose from the unit operation. In randomly selected cases workers were assigned TLD dosimeters in the form of a ring to be worn on the hand or in the form of a clip to be attached to the clothing for measurement of the hand or body dose from a unit operation. During each survey, several workers were given TLDs that were worn for the duration of the shift, and some workers, in addition, were given dosimeters to be worn for the duration of the study. Results showed that the workers who handled the radioactive packages did not receive any significant radiation exposure. (CH)

22518 (ORNL-tr-4010) RESIDUAL RADIATION FROM THE ATOMIC BOMB AT HIROSHIMA. Takeshita, K. Translated by H. Kubota from Hiroshima Daigaku Genbaku Hoshano Igaku Kenkyusho Nenpo; 13: 1-8(1972). 14p. Dep. NTIS $4.00.

Estimates are presented on the radiation dose rates to the population due to external radiation during the first few days following the explosion of an atomic bomb at Hiroshima. All available data on induced radioactivity in the region centered on the epicenter and the distribution of radioactive fallout were used for estimates of the dose rate to the population in various locations of the city and early entrants to the city. (CH)

22519 RADIOBIOLOGICAL ASSESSMENT OF THE SPATIAL DISTRIBUTION OF RADIATION DOSE FROM INHALED PLUTONIUM. Blair, W. J.; Richmond, C. R.; Wachholz, B. W. (Atomic Energy Commission, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

Permissible limits for the respiratory intake of radioactive materials are commonly calculated on the assumption of complete absorption of the radiation energy by the critical organ and that there is a uniform distribution of energy deposition throughout the organ. The consequences of basing an evaluation of the effects of inhaled plutonium on these assumptions is examined. It is concluded that the nonuniform dose distribution of plutonium particles in the lung is not more hazardous, and may be less hazardous, than if the plutonium were uniformly distributed. It is stated that the mean dose lung model is a radiobiologically sound basis for establishment of plutonium standards. (SFL)

22520 ADRENOCORTICAL POSTIRRADIATION FIBROSIS. Sommers, S. C.; Carter, M. E. (Lenox Hill Hospital, New York). Arch. Pathol.; 99: No. 8, 421-423(Aug 1975).

An autopsy, the adrenal zona reticularis showed linear hyaline fibrosis in 19 cases of cancer, after averages of six months and 5,000 roentgens of irradiation to the abdominal, lumbar, or pelvic regions. The associated roentgen dose was significantly greater than when postirradiation adrenal fibrosis was absent. Primary radiation damage to the reticular vascular plexus is suspected. (auth)

22521 BOWEL DAMAGE AFTER RADIATION THERAPY OF CARCINOMA OF THE CERVIX. Ptacek, J. J. (Univ. of Iowa, Iowa City). J. Iowa Med. Soc.; 64: No. 12, 510-512(Dec 1974).

Radiation damage to bowel is increasing in frequency in patients treated for invasive carcinoma of the cervix (as is the cure rate). Symptoms of bowel damage can occur many years after the therapy and may be confused with recurrent cancer or development of a primary bowel cancer. The care of patients presents a difficult challenge to physicians, but every effort must be made to provide proper care for these women who many times have been cured of their cervical cancer. (auth)

22522 SURGICAL PROBLEMS IN THE EXCISION AND REPAIR OF RADIATED TISSUE. Robinson, D. W. (Univ. of Kansas, Kansas City). Plast. Reconstr. Surg.; 55: No. 1, 41-49(Jan 1975).

From annual meeting of the American Association of Plastic Surgeons; Seattle, WA (13 May 1974).

Surgical procedures for tissues damaged by radiation are fraught with the possibility of multiple and serious complications. A knowledge of the altered pathophysiology of such tissues (chiefly diminished blood supply, fibrosis, and direct cellular reparative potential) is necessary for the surgeon to make a proper judgment. Recognition of the pathognomic signs in the skin is important. The possibility of malignant change must be kept in mind. Surgical treatment must include the excision of radiated tissues back to good blood supply, and then proper and adequate coverage by the simplest and best means. If the surrounding local tissues are so altered that they are unsuitable for coverage, structures from a distance must be used. Prior planning of the coverage before the excision pays dividends by preventing disastrous complications. (auth)

22523 TREATMENT OF CHOROIDAL MELANOMAS WITH $^{106}Ru/^{106}Rh$ BETA-RAY APPLICATORS. Lommatzsch, P. (Humboldt Univ., Berlin). Surv. Ophthamol.; 19: No. 2, 85-100(1974).

Cobalt-60 applicators have become an accepted means of modern therapy in patients suffering from choroidal melanoma. Other radionuclides were tested for their applicability to improve radiotherapeutic methods and to avoid radiogenic complications. Beta-ray applicators using $^{106}Ru/^{106}Rh$ (E/sub max/ equals 3.5 MeV) seem suitable because of smaller penetration depth. The optimum dose rate of the applicators seems to be 500 to 1,000 rad/h. This corresponds to an activity of about 0.5 to 1.0 mCi. Experimental irradiation with $^{106}Ru/^{106}Rh$ eye applicators of normal rabbit eyes showed that large doses (up to 500,000 rad) can be delivered to the sclera without any danger of perforation. There is a sharp boundary between tissue affected by beta irradiation and normal eye tissue. Surface doses of 100,000 rad will be tolerated by the posterior part of the human sclera, but it is desirable not to exceed this limit. Experimental intraocular Brown-Pearce tumors in rabbits could be destroyed by beta irradiation without any serious ocular damage in 9 out of 27 animals. The therapeutic results in 62 patients suffering from choroidal melanomas treated with $^{106}Ru/^{106}Rh$ beta-ray applicators are discussed. Forty-six of the irradiated melanomas were treated successfully. The tumor damaging dose should be 8,000 to 10,000 rad at the peak of the tumor. This means that 100,000 rad may be delivered at the tumor base within 8 to 14 days. Ruthenium-106/rhodium-106 beta irradiation has proved useful in cases of malignant intraocular tumors with a height not exceeding 5 mm or 12D. (auth)

22524 IRRADIATED VAGINA. Abitbol, M. M.; Davenport, J. H. (State Univ. of New York, Stony Brook). Obstet. Gynecol.; 44: No. 2, 249-256(Aug 1974).

The gross and microscopic changes following different modes of therapy for 97 cases of Stage I and II carcinoma of the cervix were studied. Features frequently present in the radiotherapy patients were: narrowing or obliteration of the vagina, pelvic fibrosis, pain or discomfort on pelvic examination, and gross and microscopic changes in the vagina typical of radiation fibrosis; in addition, the vaginal cytology was not altered after estrogen stimulation. These features were less frequent in the surgical patients. Of all the organs in the body, the vagina is exposed to the heaviest doses of irradiation. (auth)

22525 ROLE OF RADIOTHERAPY IN THE TREATMENT OF ORAL CANCER. Vermund, H.; Rappaport, I.; Nethery, W. J. (Univ. of California, Irvine). J. Oral Surg.; 32: No. 9, 690-695 (Sep 1974).

Before radiotherapy can be initiated, the patient must be examined thoroughly according to specific protocol to determine the extent of the tumor. Surgical resection accompanied by radiotherapy may be necessary in instances of persistent carcinoma. The radiation response of the tumor must be evaluated, and the optimal tumor dose must be determined to ensure maximum destruction of the tumor and minimum damage to normal tissues. Follow-up examinations should emphasize good oral hygiene to prevent further disease. (auth)

22526 SIGNIFICANCE OF RADIATION-INDUCED CHROMOSOME ABNORMALITIES IN RADIOLOGICAL PROTECTION. Dolphin, G. W.; Lloyd, D. C. (National Radiological Protection Board, Harwell, Eng.). J. Med. Genet.; 11: No. 2, 181-189(1974).

A brief review is given of the production and analysis of chromosome aberrations induced by ionizing radiation. The various tissues in which it is possible to demonstrate aberrations are noted and particular emphasis is laid on the culture of peripheral blood lymphocytes. Some examples of recent applications of the technique are described. These are in the determination of suspected overdoses to radiation workers, in estimating doses to radiotherapy patients, and investigating the depth/biological damage profile for a negative pi meson beam. (auth)

22527 RESULTS OF TREATMENT OF ADVANCED CANCERS OF THE BREAST BY INTRAPITUITARY IMPLANTATION OF RADIOACTIVE YTTRIUM. Fasching, W.; Wense, G.; Zangl, A. Bull. Soc. Int. Chir.; 33: 81-84(Mar 1974). (In French).

In the last 15 years 162 radioactive implants into the sella turcica were carried out and our overall mortality from this procedure is 12%. In 10 cases, death was due to general cachexia and wasting from carcinoma. The most remarkable feature of these results was the initial disappearance of symptoms in 47% of cases. The best results were obtained in patients with bony metastases, less satisfactory results were seen in patients with lung metastases, while patients with liver and cerebral secondaries did not respond to this form of treatment. Eleven cases were complicated by rhinorrhoea, but this was not a serious problem since it disappeared spontaneously except in 2 cases, which were treated by operation. (auth)

22528 PREOPERATIVE IRRADIATION AND RADICAL CYSTECTOMY FOR BLADDER CANCER. Reid, E. C.; Mount, B. M.; Sullivan, N. (McGill Univ., Montreal). Urology (Ridgewood, N. J.); 1: No. 1, 42-45(Jan 1973).

From 70th annual meeting of the New York Section of the American Urological Association Inc.; Montreal, Canada (24 Oct 1972).

Ninety patients were given preoperative irradiation (2,000 rads in four days) followed by radical cystectomy for bladder carcinoma. Early results suggest that the biologic effect of this irradiation regimen may be similar to or greater than the more protracted courses reported in the literature. The greatest benefit from combined therapy compared to the results from either modality alone, may be seen among patients with high-stage disease. The occasional salvage of stage D_1 cases would appear to justify external iliac and obturator lymphadenectomy in potentially curable patients. (auth)

22529 ORGANIZATION AND WORK OF THE NRPB. Harwell; National Radiological Protection Board (1975). 12p.

The functions and powers, the organizational structure, and financial arrangements of the National Radiological Protection Board (UK), created in 1970, are stated. One of the functions of the Board is to advance by research or otherwise the acquisition of knowledge about the protection of mankind from radiation hazards. Work is surveyed which is being carried out: In the Research and Development Division on: the metabolism of plutonium, removal of plutonium from the body, ^{14}C studies, inhalation studies, chromosome aberration studies, neutron studies, thermoluminescence, applied physics, computer techniques. In the Operations Division on: environmental radiation and public health, health physics measurements, instrumentation, medical equipment, advisory services, reviews of design of laboratories and installations, monitoring of premises, personal monitoring, instrument calibration and testing, tests on materials and equipment, training, incidents and accidents. In the Medical Division on: population exposures from medical radiology, occupational radiation exposure. (UK)

22530 SOME PROBLEMS OF MANDIBULAR OSTEORADIONECROSIS. Barlovic, M. Acta Stomatol. Croat.; 8: 47-53(1974). (In Slovak).

The existing problem of osteoradionecrosis has induced the author to consider some of its aspects. The elements determining therapy are the clinical appearance, x ray, and general condition of the patient. The author puts forward possibilities for the conservative (medicamentous) therapy and possibilities and dilemmas in the application of surgery. Special consideration is given to an aspect of the prophylaxis of necrosis: the extraction of teeth or their roots and removal of the metal denture from the radiation field. Preoperative and, particularly, cobalt and betatron radiation is discussed from the point of view of the development of osteoradionecrosis following these kinds of radiation. The author points out the lack of data on processes in the region of the temporomandibular joint in adults after the radiation of tumors in the immediate vicinity of the joint. (auth)

22531 EARLY RADIATION REACTIONS OF THE UPPER RESPIRATORY TRACT MUCOUS MEMBRANE DURING GAMMA THERAPY OF LARYNX AND LARYNGOPHARYNX TUMORS,

THEIR PROPHYLAXIS, AND TREATMENT. Seniukov, M. V. Zh. Ushnykh Nosovykh Gorlovykh Bolez.; 3: 9-13(1974). (In Russian).

Early radiation reaction of the mucous membrane of the upper respiratory tract occurring during radiotherapy of malignant laryngeal and laryngopharyngeal neoplasms and description of their clinical course and focal dosages at which the reactions appear are discussed. The necessity of the cure of the oral cavity as well as treatment of inflammatory processes in the upper respiratory tract before radiotherapy is commenced is stressed. In addition, 4 to 5 days before the beginning of radiotherapy it is necessary to prescribe the patients drugs having antihistamine, desensibilizing, and antiphologistic effect combined with drugs, normalizing vascular and tissue permeability. These measures substantially decrease the number of radiation reactions. Radiotherapy was interrupted only when membranous epithelilitis appeared and in such cases antiphlogistic treatment was conducted. (auth)

22532 PREVENTION OF TRACHEAL STOMA RECURRENCES AFTER TOTAL LARYNGECTOMY BY POSTOPERATIVE IRRADIATION. Schneider, J. J.; Lindberg, R. D.; Jesse, R. H. (Univ. of Texas System Cancer Center, Houston). J. Surg. Oncol.; 7: No. 3, 187-190(1975).

Patients with advanced glottic cancer, in whom there is extensive subglottic disease and/or low cervical lymph node metastasis, have a high incidence of recurrence in and about the tracheal stoma. Stoma recurrences can be prevented by immediate postoperative megavoltage radiotherapy when the stoma is included in the irradiated volume. (auth)

22533 RADIATION THERAPY IN THE MANAGEMENT OF PATIENTS WITH BREAST CANCER: WHY, WHERE, AND WHEN. Webber, B. M.; Glicksman, A. S. (Rhode Island Hospital, Providence). R. I. Med. J.; 57: No. 11, 464-471(Nov 1974).

The applications of radiation therapy in the management of all stages of breast cancer has been reviewed. It is obvious that, as the disease progresses through its spectrum from early subclinical cancer to far-advanced incurable disease, the uses of radiation vary. In the very early case irradiation is a valuable primary therapeutic method and when properly administered, offers the probability of long-term local control which is equivalent to that offered by radical surgery. It is advised that radiation treatment be reserved for those who ultimately manifest evidences of local tumor recurrence on the chest wall or in the regional node-bearing areas. When such manifestations occur, intensive radiation to the appropriate areas is indicated and has a high probability of eradicating the local tumor. In patients in whom the disease is moderately advanced so that they are essentially inoperable by reasonable standards, radiation therapy can play an important role in preparing the local field for surgical intervention. A combination of preoperative irradiation and mastectomy in these patients offers the highest probability of permanent local control of tumor. It is postulated that the addition of prolonged chemotherapeutic management in such patients may be of value in reducing the tumor burden within the inevitable metastatic deposits which are present. Whether or not treatment of this sort can completely eliminate these metastases remains to be seen. In the patient with far-advanced metastatic disease, radiation therapy is a valuable local method of palliation, offering an excellent therapy controlling symptoms in such areas as the eye and the central nervous system. Tumor which recurs on the chest wall following prior treatment with supervoltage irradiation can often be well managed by re-irradiation with the electron beam. (auth)

22534 PANCYTOPENIA AFTER IRRADIATION OF THE SPLEEN IN MYELOFIBROSIS. Reiner, M. (Inselspital, Bern). Schweiz. Med. Wochenschr.; 104: No. 39, 1383-1385(28 Sep 1974).

Four patients with primary myelofibrosis and myeloid metaplasia are described. They first received low-dose splenic irradiation and later underwent splenectomy. Whereas 4½ weeks after radiation therapy they all presented with severe pancytopenia, the contrary occurred following splenectomy since both platelets and white blood cells rose sharply in three patients and with some delay in the fourth. The pancytopenia observed after splenic irradiation therefore cannot be explained by the destruction of hematopoietic foci in the spleen. Rather, these findings can be interpreted as the result of a transient generalized inhibition of hematopoiesis by humoral factors liberated by the irradiated spleen. (auth)

22535 SERUM ANDROGENS DURING TREATMENT WITH RADON WATERS IN SWIERADOW SPA. Halawa, B.; Kwiatkowski, J. (Instytutu Chorob Wewnetrznych, Wroclaw). Pol. Tyg. Lek.; 29: No. 49, 2129-2130(9 Dec 1974). (In Polish).

The authors investigated changes in the levels of androgens in the serum of patients treated with radon waters in the Swieradów spa. A 1.8 times rise was observed in the serum level of these hormones after nine baths in radon waters and this level rose 2.2 times in relation to the initial value after the end of treatment. No changes in the level of testosterone-binding proteins were observed. The observed rise in the level of androgens depended probably on radiation emitted by products of radon disintegration. (auth)

22536 ^{60}Co TELEGAMMATHERAPY TECHNIQUE FOR TREATMENT OF ORAL PLANOEPITHELIAL CARCINOMA. Skolyszewski, J.; Reinfuss, M.; Byrski, E. (Zakladu Rentgenoterapii Instytutu Onkologii, Krakow). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 2, 189-194(1975). (In Polish).

The technique of radical megavoltage teleradiotherapy of oral planoepithelial carcinoma used by various authors is described. On the basis of assessment of isodose distribution and measurements on anatomical head and neck phantom two techniques of ^{60}Co radiotherapy have been elaborated in detail which are used in typical cases of oral carcinoma. (auth)

22537 ^{60}Co TELEGAMMATHERAPY TECHNIQUE FOR TREATMENT OF ORAL PLANOEPITHELIAL CARCINOMA. Skolyszewski, J.; Reinfuss, M.; Byrski, E. (Inst. of Oncology, Krakow). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 2, 195-200 (1975). (In Polish).

The authors describe the techniques of radical megavoltage teleradiotherapy used in cases of planoepithelial carcinoma of the maxillary sinus by various authors. On the basis of assessment of isodose distribution curves and measurements on an anatomical head and neck phantom a technique of ^{60}Co radiotherapy was elaborated in which the tumor is treated with one flat beam from the front and two lateral opposite beams with wedge filters. (auth)

22538 FREQUENCY OF DETECTION OF CANCER CELLS IN THE ABDOMINAL CAVITY UNDER THE COMBINED THERAPY FOR RECTAL CANCER. Zybina, M. A.; Kondratskaya, R. N.; Mel'nik, A. N. (Inst. of Roentgeno-Radiology, Kiev). Vop. Onkol.; 21: No. 6, 59-65(1975). (In Russian).

In 53 patients with rectal cancer, subjected to an intensive preoperative gamma therapy, and 14 patients, treated only surgically, washings from the abdominal cavity obtained intraoperatively were studied cytologically. Cancer cells were detected in every second patient of both groups. The frequency of their detection was conditioned by cancer localization in the rectum and a degree of its intraparietal spread. The data obtained indicate the efficacy of intensive preoperative irradiation that causes a radiation damage of tumor cells disseminated intraabdominally during the operative intervention. (auth)

22539 EFFECT OF RADIOTHERAPY ON THE COURSE OF TUMOR PROCESS IN PATIENTS WITH LARYNGEAL CANCER. Kochetkova, V. A.; Voronova, L. E. (Research Inst. of Oncology, Moscow). Vop. Onkol.; 21: No. 6, 44-48(1975). (In Russian).

The authors have studied the effect of radiotherapy on immune responsiveness in 36 patients with laryngeal cancer. The kinetics of variations in the skin cover bacterial picture, as well as some indices of nonspecific (anti-infective) humoral immunity (the titre of agglutinines, general bactericidity of blood sera against the proper staphylococci of the skin, and the content of staphylococcic antitoxin) were followed up depending on dosage of irradiation. It was found that radiation therapy with the total focal dosage of 2000 rad in 72% of cases contributed to activation of protective forces of the organism; in larger doses (2001 to 8000 rad) of irradiation the indices of nonspecific immunity in every patient were found to be reduced. (auth)

22540 CLINICAL EXPERIENCE WITH RADIATION SYNOVECTOMY IN THE TREATMENT OF CHRONIC SYNOVITIS OF THE KNEE JOINT. Long-Term Investigation. Hrncir, Z.; Kubicek, J.; Vavrina, J. (Karlova Univ., Hradec Kralove, Czech.). Cas. Lek. Cesk.; 113: No. 31, 937-940(2 Aug 1974). (In Czech).

In 72 subjects with chronic synovitis of the knee joint, intraarticular instillation of 5mCi radioactive yttrium colloid [^{90}Y] was used. In 42 reactive cases of synovitis in gonarthrosis, the procedure was a complete success (i.e., disappearance of complaints and punctio sicca) 18 times, in 10 cases of reactive synovitis after injury 6 times, and in 20 cases of progressive polyarthritis 14 times. In reactive synovitis from local causes, a complete effect was obtained on average after 3.1 months, in progressive polyarthritis after 2.1 months. Reactive synovitis in gonarthrosis had persisted before the above procedure was used on average for 12.6 months, where synovectomy with ^{90}Y was successful and on average 59.2 months where treatment failed; this difference was statistically significant ($p < 0.0388$). (auth)

22541 METHODS OF TELE-GAMMATHERAPY IN COMPLEX TREATMENT OF ACUTE LYMPHOBLAST LEUKEMIA

IN CHILDREN. Sarkisyan, Yu. Kh; Bentsianova, V. M.; Efremenko, S. G.; Linchevskaya, G. A.; Moiseenko, E. I. (Moscow Scientific-Research Rentgeno-Radiological Inst.). Med. Radiol.; 20: No. 6, 3-6(Jun 1975). (In Russian).

Taking into consideration high radiosensitivity of the outgrowth of bones and the necessity to spare maximally the brain during irradiation of children with acute lymphoblast leukemia, the authors developed the method of tele-gammatherapy with the use of a lead grid. Irradiation of the brain is conducted from two opposite fields (with sizes 10 × 14, 12 × 16 cm) through the lead grid, with the ratio between open and closed regions 1:1. A single exposure dose from each field is 200 rad, with a daily irradiation from two directions. The averaged focal dose is 130 to 140 rad for a fraction. The cumulative focal averaged dose in the whole brain can be 2000 to 2500 rad. According to the mentioned method the authors conducted treatment in 13 patients with a lymphoid variant of acute leukemia. The patients endured the operation rather satisfactorily, without marked manifestations of the general reaction and changes in the peripheral blood analysis. The local reaction was marked as a reticular epilation corresponding to the open parts of the grid. (auth)

22542 INDICES OF PERIPHERAL BLOOD OF PATIENTS SUFFERING FROM LYMPHO-GRANULOMATOSIS IN RADIATION THERAPY ACCORDING TO A RADICAL PROGRAM. Shishkin, I. P. (Moscow Inst. of Medicine). Med. Radiol.; 20: No. 6, 42-48(Jun 1975). (In Russian).

In 103 patients with lymphogranulomatosis the authors studied the picture of blood in the process of radiation therapy according to a radical program, and also after termination at early and remote terms. It was found that irradiation did not result in disastrous changes of the hemopoietic system. The indices of peripheral blood were restored to the norm by the 6th month after the treatment in the majority of the patients. Only in some patients, more frequently in the group with irradiated lymph nodes higher or lower the diaphragm, moderate leukopenia, and lymphocytopenia were preserved. (auth)

22543 ASSESSMENT OF RADIATION REACTIONS OF MALIGNANT TUMORS BY THE ACTIVITY OF BLOOD SERUM ENZYMES. Neumeister, K.; Herrmann, T.; Kamprad, F.; Iahns, I.; Bolck, M. (Univ., Dresden). Med. Radiol.; 20: No. 6, 39-42(Jun 1975). (In Russian).

The authors report of the preliminary results of investigation of the activity of lactate dehydrogenase, maleate dehydrogenase, and cholinesterase of the blood serum in 200 patients with malignant tumors in comparison with the results of radiation therapy. (auth)

22544 COMPARATIVE CHARACTERISTICS OF THE EFFECT OF COMBINED METHODS OF TREATING GASTRIC CARCINOMA ON THE FUNCTIONAL CONDITION OF THE LIVER. D'yakova, A. M.; Androsov, N. S.; Stefani, N. B. (Scientific-Research Inst. of Medical Radiology, Obninsk, USSR). Med. Radiol.; 20: No. 6, 35-39(Jun 1975). (In Russian).

The authors studied the functional condition of the liver with the help of biochemical liver tests in combined treatment of gastric carcinoma. The results of investigation were processed with the help of calculation of the irregular, two-factor dispersion complex. The liver selectivity on the character of the therapeutic influence was revealed. The greatest changes of the functional hepatic tests were noted in combination of a preoperative radiation therapy and surgery the smallest ones — in combination of radiation and chemotherapy. The functional condition of the liver depends upon the volume of surgical intervention. No relation between the localization of the tumor in the stomach and the disorder of the liver function in the process of treatment was observed. (auth)

22545 INTEGRAL DOSES AND THEIR CLINICAL SIGNIFICANCE IN STATIC AND MOBILE GAMMA-THERAPY OF CERVIX UTERI CANCER. Kim, O. M.; Zholkiver, K. I. (Kazakh Scientific-Research Inst. for Oncology and Radiology, Alma-Ata, USSR). Med. Radiol.; 20: No. 6, 31-34(Jun 1975). (In Russian).

The authors calculated the values of integral doses for static irradiation of the small pelvis (4 fields, 6 × 15, DSS = 75 cm) and also for mobile irradiation in three variants (fields on the axis of oscillation 4 × 15, 6 × 15, 8 × 15, 2 and 4 centers of oscillation, angle of oscillation 130, 160, and 180°. The values of integral doses depend little on the method of irradiation and find themselves within the range of 18 to 23 Mg-rad. The specific radiation load on the normal tissues in static irradiation is seven times higher than with mobile irradiation. The value of the integral dose depends on the total focal dose and the body weight. Thus, with increase of the weight of the patients from 52 to 88 kg the integral dose increases two-fold irrespective of the method of irradiation. Irradiation in a dose of 4000 rad (point B) both in mobile and static irradiation of the small pelvis brings about considerable leukolymphopenia, no substantial changes depending upon the method of irradiation being noted. (auth)

22546 CONDITION OF ILIAC LYMPHATIC PLEXUS AT DIFFERENT STAGES OF COMBINED RADIATION THERAPY OF CERVIX UTERI CANCER. Vishnevskaya, E. E. (Scientific-Research Inst. for Oncology and Medical Radiology, Minsk). Med. Radiol.; 20: No. 6, 26-30(Jun 1975). (In Russian).

The author studied the character of functional and morphological changes in the lymphatic vessels and the iliac zone nodes of the lymphatic system in 127 patients with cervix uteri cancer, who had undergone lymphography at different stages of radiation therapy. Correlation was established between the changes in the lymph nodes and vessels, size of cumulative focal dose, and the length of the interval between the end of irradiation and the time of lymphography. Roentgenological criteria on differential diagnosis of radiation changes and metastatic affections of the lymphatic vessels and nodes were determined. (auth)

22547 TREATMENT OF URINARY BLADDER CANCER RELAPSES FOLLOWING RADIATION THERAPY. Peresiegin, I. A.; Sarkisyan, Yu. Kh.; Antonova, A. M. (Moscow Inst. of Medicine). Med. Radiol.; 20: No. 6, 22-26(Jun 1975). (In Russian).

The authors elaborated methods of tele-gammatherapy through lead grids, which make it possible to conduct the second and if necessary the third course of irradiation of patients with relapses of the urinary bladder cancer which had developed after radiation therapy. This method makes it possible to apply the necessary dose (6000 to 7000 rad) to a recurrent tumor without marked radiation reactions on the part of the urinary bladder mucosa, other organs and tissues of the small pelvis. The positive local effect (disappearance or reduction of the recurrent tumor) in repeated irradiation through lead grid was two times higher than that in tele-gammatherapy conducted from the open field. The remission time after the repeated radiation therapy through lead grids was longer than that conducted from the open field. (auth)

22548 METHODS OF PREOPERATIVE IRRADIATION IN MAMMARY GLAND CANCER. Datsenko, V. S.; Dugorzhapov, M. O.; Nikologorskii, A. V. (Central Inst. for Advanced Training for Physicians, Moscow). Med. Radiol.; 20: No. 6, 17-22(Jun 1975). (In Russian).

The authors present the methods of preoperative irradiation in mammary gland cancer. On the basis of the results obtained from anatomy, lymphography, phlebography, and dosimetric investigations the authors propose figure fields for the irradiation of mammary gland and lymph outflow zones. During a prolonged dynamic observation made over 324 patients from 1 to 9 years, the decrease of the radiation complications number and a favorable therapeutic effect were observed. (auth)

22549 RESULTS OF CHEMO-RADIATION TREATMENT OF ESOPHAGUS CANCER. Kusherbaev, S. K.; Dement'eva, N. I.; Balmukhanov, S. B. (Kazakh Scientific-Research Inst. of Oncology and Radiology, Alma Ata, USSR). Med. Radiol.; 20: No. 6, 13-17(Jun 1975). (In Russian).

The authors used chemo-radiation therapy with the administration of methotrexate (4 mg, 2 to 6 hours before irradiation) for the treatment of 120 patients with esophagus cancer. Dependence of the results of chemo-radiation treatment upon the age of the patients, size of the tumor, markedness of side effects (esophagitis), and degree of radiation regression of the tumor was determined. (auth)

22550 RADIATION TREATMENT OF LARYNX CANCER RELAPSES. Morozov, A. I.; Rogachikova, T. A.; Devyatykh, Yu. N. (Moscow Regional Scientific-Research Clinical Inst.). Med. Radiol.; 20: No. 6, 8-12(Jun 1975). (In Russian).

The authors studied the causes for the development of larynx cancer relapses depending upon the degree of the tumoral process spreading, timely carrying out of the combined treatment stages, and character of the preceding irradiation. It was established that the relapses developed more often after roentgenotherapy conducted earlier (135 out of 168). As a rule, neglected larynx cancer of the 3 to 4th degree relapsed after irradiation with insufficient doses — less than 6000 rad. The greatest number of relapses in 166 out of 168 patients developed in the course of the year after the primary treatment. The main method of the relapse treatment was a combined one — 110 patients; in 46 patients the authors used tele-gammatherapy through a negative and positive grid; in 12 patients — chemoradiation treatment. Irradiation was conducted in doses of 6600 to 7000 rad. As a chemopreparation TioTEF, cyclophosphan, and spirazidin were used. Radical operation was possible in 45 patients. A 5-year recovery was observed in 55 out of 168 patients (34.4%). The best results were observed during the treatment of relapses in the tracheostome region, laryngo-pharynx, the worst — in the

relapse in the trachea region, radix linguae, and esophagus. (auth)

22551 RADIATION PROPHYLAXIS OF NEUROLEUKEMIA IN CHILDREN WITH ACUTE LYMPHOBLAST LEUKOSIS IN THE PERIOD OF CLINICO-HEMATOLOGICAL REMISSION. Vorob'ev, Yu. I.; Garbuzov, M. I. (Moscow Medical Stomatology Inst.). Med. Radiol.; 20: No. 6, 6-8(Jun 1975). (In Russian).

The authors conducted tele-gammatherapy with irradiation of the brain and meninx in 11 children with acute lymphoblast leukosis. In two cases, the treatment of the clinically developed neuroleukemia was ineffective. In nine cases, irradiation was of a prophylactic character and started immediately after obtaining clinico-hematological remission. Of this number, in seven cases, the signs of neuroleukemia (time of observation from 1 to 13 months) were not observed. The experience shows great value of the so-called prophylactic irradiation of the brain and meninx in all the children with acute lymphoblast leukosis in the early period of clinico-hematological remission, in the pre-clinical phase of neuroleukemia development. Irradiation is recommended to be made from 2 side parallel figure fields by focal doses in the range between 2000 ± 500 rad along the mean line, taking into account the age of children. In children of one year of life the focal dose must be—1500 rad, in children from one to two years—2000 rad, older than two years—2500 rad. For the final assessment of the most optimal doses it is necessary to conduct remote observations over children, taking into account the time of remission, frequency and severity of radiation changes. (auth)

22552 DISTRIBUTION OF BREMSSTRAHLUNG RADIATION 25 MeV DOSES ALONG THE SURFACE LAYERS OF IRRADIATED TISSUE. Milshtein, R. S.; Ankudinov, V. A. (Moscow Scientific-Research Rentgeno-Radiological Inst.). Med. Radiol.; 20: No. 6, 58-60(Jun 1975). (In Russian).

The authors present the results of investigation of bremsstrahlung radiation of relative input doses of high energy under different irradiation conditions. Measurements were made with the help of a flat ionization chamber the front wall of which was made of aluminium foil (thickness 10μ). Depending upon the beam parameters and conditions of the irradiation, relative input doses changed from 9 to 30 per cent. (auth)

22553 INCREASE IN INCIDENCE OF CHROMOSOME ABERRATIONS FOLLOWING SHAKING OF SMALL CIRCULATING LYMPHOCYTES FROM IRRADIATED PATIENTS. Stefanescu, D. T. (Inst. of Pathology and Medical Genetics, Bucharest); Teodorescu, M.; Mogos, I.; Brucher, J. Stud. Biophys.; 47: No. 3, 209-214(1974).

Peripheral blood lymphocytes collected from four patients who received large doses of radiations for breast cancer therapy were submitted to shaking in order to produce displacements of the chromosome broken ends. The cells were subsequently cultured for 52 hr in the presence of phytohaemagglutinin and chromosome preparations made. Significant increases in rearrangement incidence were recorded in cells collected from irradiated patients and submitted to mechanical treatment as compared with the level observed in non-shaken cells. The explanation of this finding may be that at the time of mechanical treatment chromosome breaks induced by in vivo irradiation of small lymphocytes were not rejoined. (auth)

22554 THE JUDGEMENT OF RADIOSENSITIVITY OF THE CERVIX CARCINOMA. Statistical Evaluation of the Therapy Results. Mittermayr, O. Wuerzburg, Ger.; Univ. Wuerzburg (1973). 75p. (In German). INIS.

Thesis.

Following a comparison of the results of surgery and radiotherapy which yield nearly the same chance of healing, a definition is given of the terms radiosensitivity, radiocurability, and radioresistance. The known methods of testing for radiosensitivity are described. A modified assay developed at the Universitaets-Frauenklinik Wuerzburg is presented. After examination of the patients in anesthesia and the determination of the stage of the collum carcinoma, well preserved tumor tissue is taken from a young focus fixed in Carnoy's solution, embedded in paraffin and 5 μ slices are stained with H and E. After the first test irradiation with a percutaneous dose of 800R a second test excision is performed 8 days after the first one. In microphotographs of both samples a difference in the cells can be observed which is expressed in various parameters. Up to 500 tumor cells are counted in the preparation under the microscope. A difference of the degenerative changes before and after irradiation of more than 66% indicates a high radiosensitivity, 33 to 65% a partial, and less than 32% a low radiosensitivity. Of 100 patients 66 were suitable for the examinations. Eight of those cases showed a good, 21 cases a partial, and 37 cases a low radiosensitivity. A comparison of the results after 2 and 5 years shows in the case of good radiosensitivity no recurrences of those patients with partially sensitive carcinomas 71.4% are alive after 2 years, 52.4 after 5 years. 48.6% of the patients with low radiosensitivity were surviving after 2 years, 35.1% after 5 years. It is concluded that the method is a good criterium for the selective procedure between cases to be treated either by radiotherapy or by surgery. (GE)

22555 HUMAN ECOLOGY AND INDUSTRIAL SOCIETY. Bocquet, H. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 209-215 of 8th Congress National sur le Controle des Rayonnements Ionisants. Chatenay-Malabry, France; Association des Techniciens Superieurs en Radioprotection (1973). (In French).

From 8th Congress of the Health Physicist's Association; Chatenay-Malabry, France (5 Jun 1973).

Within the context of an analysis of the problems arising from an industrial society answers are given to a few questions concerning, inter alia, the present world situation with respect to the health physics of man due to his environment, apart from the medical and directly professional aspects, the dose limits, ecology, and last to what extent the regulation of the living conditions of workers can serve as model for pollution regulations and contribute to improving the regulations on the protection of the population. (FR)

22556 NUCLEAR CURES. To the Point; 25(24 Jan 1975).

When the Zen Rad computerised radioisotope patient processing and radiation treatment planning system is handed over to the National Hospital at Bloemfontein by the local representatives of the Zentron Corporation of Dallas, Texas, on January 31, the Republic will have its first highly sophisticated radiotherapy system. The full program has taken two years to set up and refine. The computer, which cost R160,000, enables the radiotherapy team to examine the patient, assists the final diagnosis, and is used to plan the direction and dosage of the therapy equipment. (INIS)

22557 THERAPEUTICALLY INDUCED RADIATION CANCER OF THE SKIN. Nitrov, G.; Ikonopisov, R. L. Probl. Onkol.; 1: 87-93(1973). (In Russian).

A case of therapeutically induced radiation cancer of the skin is reported occurring 52 years after x-ray epilation for a deep mycosis of the capillitium. The severe radiation damage to the exposed areas is described as well as the subsequent invasive squamous cell carcinoma destroying the underlying bone structures of the skull. Good therapeutic results are observed with systemic and local administration of bleomycin. (Abstr. Bulg. Sci. Med. Lit.)

22558 RADIOTHERAPY FOR PURE SEMINOMA OF THE TESTIS. Doornbos, J. F.; Hussey, D. H.; Johnson, D. E. (Univ. of Texas, Houston). Radiology; 116: No. 2, 401-404(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Testicular tumors initially diagnosed as pure seminoma were irradiated following orchiectomy in 141 patients. Analysis of treatment failures reveals that: 2500 rads is adequate for elective irradiation and 3500 rads for small to moderate-sized metastases; elective irradiation of the mediastinum and left supraclavicular area is not indicated for Stage I, but is for Stage II; patients with bulky retroperitoneal disease should be treated initially through total abdominal portals followed by additional treatment through reduced fields; and presence of embryonal carcinoma, teratocarcinoma, or choriocarcinoma should be considered when regression is poor. (auth)

22559 POSTRESECTION IRRADIATION FOR PRIMARY LUNG CANCER. Green, N.; Kurohara, S. S.; George, F. W. III; Crews, Q. E. (San Diego Naval Hospital, CA). Radiology; 116: No. 2, 405-407(Aug 1975).

A total of 219 patients with proved lung cancer were studied to determine whether postresection irradiation improves survival. The results showed that postresection irradiation improved survival among patients with hilar and mediastinal lymph-node metastases of all histological types but did not improve survival among patients without node metastases. The authors recommend that patients with resectable lung cancer involving the hilar and mediastinal lymph nodes be treated by a combination of surgery and radiotherapy. (auth)

22560 SERUM IgA IN THE DIAGNOSIS OF NASOPHARYNGEAL AND PARANASAL SINUS CARCINOMA. Wara, W. M.; Ammann, A. J.; Wara, D. W.; Phillips, T. L. (Univ. of California, San Francisco). Radiology; 116: No. 2, 409-411(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

The serum immunoglobulin-A level was elevated in patients with nasopharyngeal carcinoma (mean 526 +- 188 mg/100 ml) and paranasal sinus carcinoma (mean 451 +- 124 mg/100 ml)

prior to radiation therapy. After treatment, the IgA levels were lower in nasopharyngeal carcinoma patients. Elevated serum IgA values were also noted in patients with recurrent nasopharyngeal carcinoma. Serum IgA determinations may be useful as an additional diagnostic test for squamous cell carcinoma of the nasal and oropharynx. (auth)

22561 CARCINOMA OF THE MALE BREAST FOLLOWING THYMIC IRRADIATION. Deutsch, M.; Altomare, F. J. Jr.; Mastrian, A. S.; Chervenak, J. P. (Univ. of Pittsburgh). Radiology; 116: No. 2, 413-414(Aug 1975).

A white male teenager with carcinoma of the breast had received radiation therapy for an asymptomatic enlarged thymus on the second, fourth, and seventh days of life. The dose delivered to the infant breasts, the latent period, and the unusually young age of the patient suggest that the malignancy was related to the course of radiotherapy. (auth)

22562 DOSIMETRY OF HODGKIN'S DISEASE THERAPY USING A 4 MV LINEAR ACCELERATOR. Gray, L.; Prosnitz, L. R. (Yale Univ., New Haven). Radiology; 116: No. 2, 423-428(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

This report describes a detailed analysis of the dosimetry of the mantle technique for the therapy of Hodgkin's disease when a 4 MV linear accelerator (Varian) is utilized. Doses were determined in a Rando phantom and in vivo using several methods of dosimetry. Significant dose variations, exacerbated by the lead flattening filter, were found. For peripheral doses, where the nodes are near the surface (e.g., neck and axillae), increases of 20 to 30 percent were the rule. To adjust for these substantial differences, a shrinking field technique was adopted, obviating the need for complex compensating systems. The doses for the inverted Y field were relatively uniform. (auth)

22563 MANTLE FIELD DOSIMETRY COMPARING 4 MV WITH COBALT-60. Gray, L.; Prosnitz, L. R. (Yale Univ., New Haven). Radiology; 116: No. 2, 429-432(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Three off-axis dosimetric parameters were evaluated for identical mantle fields using the Varian 4 MV linear accelerator and a Picker C8M cobalt-60 unit. These parameters were dose distribution, skin dose, and integral dose. Comparisons showed higher doses in all three categories with the 4 MV accelerator when the tumor dose is specified at the central axis midline. These results emphasize the importance of off-axis dosimetry with both machines. (auth)

22564 POTENTIAL OF LOCALIZED HEATING AS AN ADJUNCT TO RADIATION THERAPY. Gerner, E. W.; Conner, W. G.; Boone, M.L.M.; Doss, J. D.; Mayer, E. G.; Miller, R. C. (Univ. of Arizona, Tucson). Radiology; 116: No. 2, 433-439 (Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Experimental studies have shown that tumor cells may be more sensitive to heat than normal cells; hyperthermia inactivates cellular repair mechanisms for radiation damage; and heat may lower the OER for ionizing radiation (anoxic cells are at least as sensitive to hyperthermia as oxygenated cells). Localized hyperthermia produced by localized current fields in the range of 1000 kHz to 10 MHz by direct contact electrodes offers two major advantages: the electrode configurations may be manipulated to obtain desired thermal dose distributions, and, since the mode of heating is essentially instantaneous, accurate temperature control can be maintained during treatment. (auth)

22565 RECTAL DOSE IN INTRACAVITARY GAMMA THERAPY OF CANCER OF THE CERVIX UTERI DETERMINED BY ELECTRONIC COMPUTERS. Dapkova, L.; Todorov, V. Probl. Onkol.; 1: 125-131(1973). (In Russian).

Statistical elaboration of data processed by electronic computers for 16 consecutive patients subjected to intracavitary gamma-therapy in cancer of the cervix uteri determines the values of the maximal dose in the anterior rectal wall — 4500 rad at full rectum and 4700 rad at an empty one. There is no substantial difference between the two doses. The maximally radiation loaded zone of the anterior rectal wall measures 2 to 4 cm of length in a cranio-caudal direction and is localized at the level of the posterior vaginal wall. Filling of the rectum does not substantially change the spacial arrangement of the applicators and the dose distribution in the pelvis. (Abstr. Bulg. Sci. Med. Lit.)

22566 EFFECT OF RADIATION THERAPY ON THE DISTRIBUTION OF FLUORINE AND HYDROXYL IN DENTAL ENAMEL OF MAN (A POLARIZATIONAL-MICROSCOPIC STUDY). Elizarova, V. M.; Segen, I. T. Stomatologiya (Moscow); 53: No. 5, 17-21(1974). (In Russian).

A method of comparative dispersion of double refraction was applied to the distribution of fluorine and hydroxyl in dental enamel after radiation therapy. Fifty microsections were studied; investigations were carried out in four successive enamel layers. The material was distributed in three groups according to the extent of enamel affection. A reduction of fluorine concentration and accumulation of hydroxyl was established in the pathologically altered enamel. Hydroxyl content was increased in all the enamel layers in the group with the greatest involvement. (auth)

22567 CHANGES OF THE FUNCTIONAL PROPERTIES OF LYMPHOCYTES IN THE PROCESS OF RADIATION THERAPY. Shiriy, A. V. Vrach. Delo; No. 7, 113-114(1974). (In Russian).

The capacity of blasttransformation of lymphocytes of the peripheral blood in culture stimulated by phytohemagglutinin was studied in 65 patients with cancer of the uterine cervix. Before radiation therapy, the percent of blasttransformation was 59.6 ± 3%; when the total focal dose reached 200 to 1500 rad it diminished to 51.8 ± 5.4% and by the end of treatment to 48.5 ± 3.6% (statistically valid differences). A relation has been found between the reduction of blasttransformation of lymphocytes and degree of lymphopenia. It is suggested that the reduction of blasttransformation is caused by irradiation of T-lymphocytes of the peripheral blood or non-established indirect mechanisms of the effect of ionizing radiation on the thymus. (auth)

22568 RADIOTHERAPY. Jelliffe, A. M. (Meyerstein Inst. of Radiotherapy, London). Postgrad. Med. J.; 50: No. 582, 231-232(Apr 1974).

The author examines the place of radiotherapy in the management of esophageal cancer. Many of these tumors are locally curable with radiotherapy. This is so particularly with the proliferative, poorly differentiated tumor. The upper and middle thirds of the esophagus are the most suitable sites for attempted cure by radiotherapy; surgery is always the better method in the lower third. Before adopting a definitive treatment policy it is important to eliminate metastatic spread as far as is possible. The overall prognosis is poor: long unnecessary courses of treatment or extensive operations should be avoided unless there is a reasonable chance of long-term cure. (auth)

22569 EFFECT OF RADON ON PERIPHERAL BLOOD COSINOPHIL COUNT. Szczeklik, A.; Kwiatkowski, J.; Rozek, D. Pol. Tyg. Lek.; 30: No. 5, 197-199(3 Feb 1975). (In Polish).

In 21 patients with peripheral atherosclerosis or degenerative joint disease the effects of radon baths were studied on the eosinophil count in peripheral blood. Determinations were carried out in the forenoon, immediately before a 30-minute bath and 90, 210, and 330 min. later. The investigations lasted 3 days and during that time the patients were subjected to baths in tap water, weakly radioactive (about 5 nC/l) water, and strongly radioactive water (about 25 nC/l). The obtained results indicate that radon baths accelerate the eosinopenic reaction occurring in the forenoon. Eosinopenia showed a correlation with the degree of radioactivity in water. Propranolol administered orally 30 min. before the bath in a dose of 40 mg failed to change the curve of eosinophil fall during the first 3.5 hours but caused return of initial eosinophil count 5.5 hours later. The fall in the eosinophil count after radon bath may depend on stimulation of the adrenergic system by radon. (auth)

22570 TASKS AND RESULTS OF RADIOBIOLOGY AS RELATED TO RADIATION PROTECTION AND THE X-RAY ORDINANCE. I. Meissner, J. (Forschungsinstitut Borstel (F.R Germany). Inst. fuer Experimentelle Biologie und Medizin). G-I-T (Glas-Instrum.-Tech.) Fachz. Lab.; 18: No. 11, 1115-1123 (Nov 1974). (In German).

A short survey is given on the early period of the diagnostic and therapeutic use of radiation. Extensive experimental and theoretical work has provided the basis for the interpretation of the reactions and symptoms after radiation exposure. It has also made possible an evaluation of the effects as a function of the radiation dose, for which some graphic charts and tables are presented. This is followed by some findings of experimental investigations of phenomenologic radiation reactions which are presented in tables and charts. (GE)

22571 TASKS AND RESULTS OF RADIOBIOLOGY AS RELATED TO RADIATION PROTECTION AND THE X-RAY ORDINANCE. II. Meissner, J. (Forschungsinstitut Borstel (F.R. Germany). Inst. fuer Experimentelle Biologie und Medizin). G-I-T (Glas-Instrum.-Tech.) Fachz. Lab.; 19: No. 1, 42-49(Jan 1975). (In German).

Numerous results are given of experimental studies on biochemical radiation effects, followed by some theoretical statements on the mechanism of radiation. A critical examination of the radiation hazards of irradiation of human populations is attempted. (GE)

22572 TREATMENT OF THE LARYNGEAL CARCINOMA. Operation, Radiotherapy, and Chemotherapy. Poser, H.; Quaeck, J.; Jacobsen, J. (Kiel Univ. (F.R. Germany). Radiologische Klinik; Kiel Univ. (F.R. Germany). Hals-, Nasen- und Ohrenklinik). Strahlentherapie; 149: No. 4, 353-363(Apr 1975). (In German).

The methods of treatment of the laryngeal carcinoma are described with a comment on the necessity of an exact distinction between the different stages of the carcinoma. Surgical and radiotherapeutical methods are mentioned. The dose rates used with the different kinds and methods of radiation are treated in more detail, and the possibility of protecting the patient's critical organs (spinal marrow) is discussed. The problem of recurring tumors is discussed with regard to the possibilities of chemotherapy. The possibilities of partial synchronisation, intra-arterial tumor therapy and polychemotherapy are mentioned. (GE)

22573 RADIATION PROTECTION OF PATIENTS IN X-RAY DIAGNOSTIC TECHNIQUES. Gerhardt, P. (Heidelberg Univ. (F. R. Germany). Chirurgische Klinik). Roentgenpraxis; 28: No. 2, 37-47(Feb 1975). (In German).

The care taken by the physician and the technical assistant is the most important factor in reducing the radiation exposure of patients. A fair relation between efficiency and possible unnecessary exposure is provided by careful and conscientious work which has to be based on sound knowledge of the effects of ionizing radiation on the organism, and of the possibilities of reducing the doses responsible for these effects. (GE)

Vertebrates

Refer also to abstracts 22468, 22479, and 22502.

22574 (ERDA-tr-31) RADIOBIOLOGY, VOL. 14, NO. 6, 1974. Translation of Radiobiologiya; 14: No. 6, 803-960(1974). 191p. Dep. NTIS $7.60.

Separate abstracts were prepared for the 39 papers presented in this issue. (ERB)

For abstracts of individual papers see: 21963, 22458–22464, 22491, 22510, 22575–22601, 22629, and 22644.

22575 (ERDA-tr-31, pp 1-5) PECULIARITIES OF THE BIOSYNTHESIS OF EUCHROMATIN AND HETEROCHROMATIN DNA IN TISSUES OF GAMMA-IRRADIATED RATS DIFFERING IN RADIOSENSITIVITY. Shrazhevskaya, N. B.; Struchkov, V. A. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 803-806(1974).

In Radiobiology.

The synthesis of euchromatin DNA (EDNA) and heterochromatin DNA (HDNA) in organs of rats differing in radiosensitivity was studied according to the incorporation of 2-^{14}C-thymidine. It was shown that in the thymus, spleen, and liver of intact rats, the synthesis of EDNA is twice as active as the synthesis of HDNA. Immediately after irradiation of the rats at a dose of 1 kR, a substantial inhibition of the synthesis of EDNA and HDNA was observed in all three organs, especially in the thymus and spleen. The synthesis of EDNA and HDNA in the spleen and thymus was irreversibly suppressed 2 and 6 hrs after the irradiation of the rats, while in the liver the synthesis of these DNA fractions was restored. This difference can evidently be determined by the ratio of the replicative and repair synthesis of DNA in these organs of rats. (tr-auth)

22576 (ERDA-tr-31, pp 6-11) INFLUENCE OF X IRRADIATION ON THE KINETICS OF THE RENATURATION OF DNA OF ASCITES HEPATOMA CELLS. Khanson, K. P.; Zhivotovskii, B. D. (Central Scientific Research Roentgenoradiological Inst., Leningrad). 1974. Translated from Radiobiologiya; 14: No. 6, 807-810(1974).

In Radiobiology.

The kinetics of the renaturation of the DNA of ascites hepatoma were studied. Three zones were isolated from the curve corresponding to rapid, intermediate, and slow rates of reassociation of DNA. A divergence of the shapes of the curves of renaturation of DNA preparations from the control and irradiated (1500 R) cells was detected, especially pronounced in the zone of the slowly renaturing sequences (10^2 less than C_0t less than 10^4). Irradiation at the same dose, however, does not produce any qualitative changes in the secondary structure of DNA, evaluated by the method of thermal elution from a column with hydroxyapatite. (tr-auth)

22577 (ERDA-tr-31, pp 28-32) RADIATION STIMULATION OF THE INCORPORATION OF ^{32}P-PHOSPHATE INTO THE PHOSPHOLIPIDS OF THE SUBCELLULAR STRUCTURES OF RAT LIVER CELLS. Kaznacheev, Yu. S. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 824-827(1974).

In Radiobiology.

The incorporation of ^{32}P-phosphate into phosphatidylcholine (PC) and phosphatidylethanolamine (PET) of the subcellular structures of rat liver cells in the normal state and 1 hr after gamma irradiation at a dose of 1200 R was investigated. The total and specific activity of PC and PET of the cell organelles of the liver of irradiated rats are 1.5 to 3.0 times as great as the normal value, which is evidence of radiation activation of the biosynthesis of phospholipids. A nonuniform increase in the incorporation of the label into PC and PET of various organelles of the liver of irradiated rats was demonstrated. Radiation stimulation of lipid biosynthesis is accompanied by changes in the exchange of labeled phospholipids among organelles. (tr-auth)

22578 (ERDA-tr-31, pp 33-38) ROLE OF THE CHANGE IN THE COMPOSITION OF LIPIDS DURING RADIATION DAMAGE AND THE ACTION OF RADIOPROTECTORS. Arkhipova, G. V.; Burlakova, E. B. (Inst. of Chemical Physics, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 828-832(1974).

In Radiobiology.

An analysis of the composition of the lipids of the spleen, liver, and brain of mice of the BALB line, irradiated at a dose of 650 R, was conducted by the method of thin-layer chromatography. Post-radiation changes in the lipid fractions of the three organs occurred synchronously: the amount of cholesterol in all the organs was increased, the amount of phospholipids was below the normal level, and the content of triglycerides, free fatty acids, and esterified cholesterol, after a series of fluctuations, returned to normal on the third day after irradiation. The administration of a radioprotector (6-methyl-2-ethyl-3-hydroxypyridine) to the irradiated animals normalized the composition of all the lipid fractions of the organs studied. A relationship was observed between the quantitative changes in the composition of the lipids and the radiosensitivity of the organs. (tr-auth)

22579 (ERDA-tr-31, pp 39-44) ACTIVATION OF DISULFIDE REDUCTASE BY MONOAMINES AS A POSSIBLE CAUSE OF THEIR THIOL-INCREASING AND RADIOPROTECTIVE EFFECTS. Kulinskii, V. I.; Ivanov, V. V. (Krasnoyarsk Medical Inst., USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 833-836(1974).

In Radiobiology.

Catecholamines (CA), mesaton, and serotonin (S), in radioprotective doses activate the NADP·H-dependent disulfide reductase activity (DSR) in the mouse spleen. The action of isadrin and adrenalin (A) is realized through the beta-receptors, that of noradrenalin (NA) through adrenoreceptors differing from the classical ones. The activation of DSR is correlated with the thiol increasing (TIE) and radioprotective (RPE) effects of the monoamines. The addition of CA and S to homogenates of the rat spleen activates the DSR to the same degree as the introduction of monoamines to the organism. Consequently, the effect is the result of a direct action on the tissues. This agrees with the concept of the possibility of realization of the RPE of monoamines at the cellular level. (tr-auth)

22580 (ERDA-tr-31, pp 57-63) REACTION OF THE MITOCHONDRIA TO RADIATION DAMAGE. Demidova, G. G.; Tkachenko, Z. Ya.; Chebotarev, E. E. (Inst. of Molecular Biology and Genetics, Kiev). 1974. Translated from Radiobiologiya; 14: No. 6, 847-851(1974).

In Radiobiology.

The reaction of the mitochondria in the neurons of the stellate ganglion and solar plexus of rabbits after whole-body x irradiation at doses of 300, 800, and 1400 R was studied by an electron microscopic method. Morphological changes in the mitochondria and an association of them with intracellular metabolic disorders in the neuron are represented in the dynamics of the development of radiation pathology. (tr-auth)

22581 (ERDA-tr-31, pp 68-72) ANALYSIS OF THE INFLUENCE OF CYSTEINE AND A COMBINATION OF IT WITH BENZONAL ON THE TOXICITY AND RADIOPROTECTIVE PROPERTIES OF SULFUR-CONTAINING RADIOPROTECTORS. Zherebchenko, P. G.; Belavina, L. P.; Besedina, L. N.; Kalistratov, G. V. 1974. Translated from Radiobiologiya; 14: No. 6, 855-858(1974).

In Radiobiology.

Experiments on mice showed that the combined use of benzonal and cysteine produces an additive reduction of the toxic effect of cystamine. Cysteine, moreover, increases the radioprotective effectiveness of cystamine. The therapeutic index of cystamine in the case of its joint use with benzonal and cysteine is increased 2.3-fold. It was shown by the method of isoboles that the antioxidant action of cysteine is due to its mutual antagonism with sulfur-containing radioprotectors. The presence of this antagonism is associated with the ability of cysteine to reduce the accumulation of cystaphos in the mouse brain. (tr-auth)

22582 (ERDA-tr-31, pp 73-78) PHARMACOLOGICAL POTENTIATION OF THE RADIOPROTECTIVE ACTION OF HYPOXIC HYPOXIA. Ovakimov, V. G.; Yarmonenko, S. P.; Kli-

mova, T. S. (Inst. of Labor Hygiene and Occupational Diseases, Moscow). 1974. Translated from Radiobiologiya; 14: No. 6, 859-863(1974).

In Radiobiology.

In a study of the radioprotective effect of hypoxic hypoxia and mexamine, histamine, adrenalin, and acetylcholine, a synergistic effect of hypoxia with the biogenic amines and acetylcholine used was demonstrated. The blocking of the pharmacological mechanism of the action of mexamine by aminazine or by alpha-methyltryptamine partially weakens the synergistic effect. Possible mechanisms of the detected phenomenon are discussed. (tr-auth)

22583 (ERDA-tr-31, pp 79-85) ROLE OF THE PLASTIC STATE OF THE CORNEAL EPITHELIUM OF THE EYE IN RESPONSE TO THE ACTION OF IONIZING RADIATION. Popova, M. F.; Bulyakov, N. V. (Inst. of Evolutionary Morphology and Ecology of Animals, Moscow). 1974. Translated from Radiobiologiya; 14: No. 6, 864-868(1974).

In Radiobiology.

A quantitative cytogenetic investigation, conducted considering the duration of the mitotic cycle, as well as the intensity of interphase death of cells of normal and regenerating epithelium, showed that the regenerating tissue is more radioresistant than normal tissue. This is explained both by the lower vulnerability of the regenerating tissue as a result of its metabolic peculiarities and by the more intensive process of postradiation recovery at the cellular level. (tr-auth)

22584 (ERDA-tr-31, pp 100-105) SOME INDICES OF THE INTENSITY OF DNA METABOLISM DURING THE 24-HOUR PERIOD IN RATS AND THEIR RELATIONSHIP TO RADIOSENSITIVITY. Mikhailov, V. F.; Druzhinin, Yu. P.; Moskaleva, E. Yu.; Fedorova, T. A. 1974. Translated from Radiobiologiya; 14: No. 6, 879-882(1974).

In Radiobiology.

The circadian rhythm of the excretion of deoxyuridine and thymidine with the urine in rats was studied under various light conditions, as well as with variation of the mobility of the animals. Excretion of nucleosides increased during the dark time of day, and more substantially in animals kept with less illumination during the light period. A correlation was detected between the radiosensitivity of the animals at different times of day and the level of nucleoside excretion. (tr-auth)

22585 (ERDA-tr-31, pp 106-108) COMPARATIVE STUDY OF THE ACTIVITY OF DEOXYRIBONUCLEASE II IN RAT URINE IN THE CASE OF ACUTE AND PROLONGED IRRADIATION. Uspenskaya, M. S.; Isergina, A. T. 1974. Translated from Radiobiologiya; 14: No. 6, 883-885(1974).

In Radiobiology.

The purpose of the study was to investigate the activity of DNAase II in rat urine in the dynamics of accumulation of the dose during prolonged irradiation and after it and compare it with the corresponding activity in the urine of animals under an acute radiation influence at an equieffective dose. The dynamics of the DNAase activity in the urine of the rats differed in the case of prolonged and acute irradiation. However, it is thought that the probable causes of its variation were the same in both cases, namely, a breakdown of radiosensitive tissues and thrombocytes. (ERB)

22586 (ERDA-tr-31, pp 109-113) INFLUENCE OF VARIOUS DOSES OF GAMMA RAYS ON THE ACTIVITY OF CERTAIN ISOENZYMES OF THE RAT BRAIN. Surinov, B. P. 1974. Translated from Radiobiologiya; 14: No. 6, 885-889(1974).

In Radiobiology.

The influence of various doses of gamma rays on the content of isoenzymes of lactate dehydrogenase, esterase, and acid phosphatase in the rat brain was studied. Variations in the five isoenzymes of lactate dehydrogenase were dose and time dependent. Disturbances in the quantities were not excessive, probably because the isoenzymes are present in various cells and tissues. The acid phosphatase of the rat brain was represented by one fraction with low mobility. Except on day 1 following irradiation, no significant deviations were observed in acid phosphatase activity in the brain probably because the sites in which it is located in the brain are not subjected to any significant postradiation damages. Five isoenzymes of esterase were isolated. The different fractions were found to vary in regards to their radiosensitivity. Isoenzyme-2 was found to be most radiosensitive. (ERB)

22587 (ERDA-tr-31, pp 122-124) INCREASE IN THE AMOUNT OF CHOLESTEROL IN THE MICROSOMAL FRACTION OF LIVER CELLS OF IRRADIATED RATS. Kolomitseva, I. K.; Kaznacheev, Yu. S.; Kuzin, A. M. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 894-896(1974).

In Radiobiology.

The changes in the lipid composition of the subcellular fractions of liver cells in irradiated rats were studied 60 min following gamma irradiation at a dose of 1200 R. Oppositely directed changes occurred in the phospholipids under the action of radiation as measured in nuclear, mitochondrial, and microsomal fractions. The change observed in the ratios phospholipid/protein, cholesterol/protein, cholesterol/phospholipid, and phosphatidylcholine/phosphatidylethanolamine is evidence of profound functional changes in the state of the subcellular organelles during the early periods after irradiation. (FRB)

22588 (ERDA-tr-31, pp 125-128) PECULIARITIES OF THE CARBOHYDRATE METABOLISM IN THE ERYTHROCYTES DURING RADIATION SICKNESS. Serebrennikova, I. A. (Tomsk Medical Inst., USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 896-898(1974).

In Radiobiology.

The purpose of the investigation was to study glycolysis and the basic enzyme systems associated with it, as well as to analyze the relationships of the pathways of anaerobic cleavage of carbohydrates in the erythrocytes during radiation sickness. The experiments were conducted on 27 rabbits irradiated on a 25 MeV betatron at a dose of 1000 rad. The results indicate that there is a disturbance in the principal pathway of glycolysis in the erythrocytes. This is associated with the fact that the activities of hexokinase and pyruvate kinase both decrease following exposure. (ERB)

22589 (ERDA-tr-31, pp 132-136) RADIOCHROMATOGRAPHIC INVESTIGATIONS OF THE CONVERSIONS OF S-(2-AMINOPROPYL)-THIURONIUM AND S-(1-AMINOPROPYL-2)-THIURONIUM THE MAMMALIAN ORGANISM. Mandrugin, A. A.; Tarasenko, A. G.; Fedoseev, V. M.; Gintsburg, E. I.; Nekrasova, I. V. (Moscow State Univ.). 1974. Translated from Radiobiologiya; 14: No. 6, 901-904(1974).

In Radiobiology.

The distribution and conversion of S-(2-aminopropyl)-thiuronium(2-APT) and S-(1-aminopropyl-2)-thiuronium(1-APT) in the organs and tissues of mice were studied to further elucidate the mechanism of the radioprotective action of aminoalkylthiuronium compounds. The results obtained are evidence that 2-APT and 1-APT, analogously to AFT and 3-APT, are converted in the organism chiefly to the corresponding heterocyclics. Mercaptoalkylguanidines were not detected among the conversion products. (FRB)

22590 (ERDA-tr-31, pp 141-143) SPECIES PECULIARITIES OF THE CYSTAMINE METABOLISM IN MICE AND RATS. Titov, A. V.; Golubentsev, D. A.; Mikhailova, E. G. (Military-Medical Academy, Leningrad). 1974. Translated from Radiobiologiya; 14: No. 6, 907-909(1974).

In Radiobiology.

In experiments on mice and rats, the penetration of cystamine into the blood, its distribution in the organism, and its conversion to MEA in various tissues were studied in order to determine whether the species differences in the toxicity of cystamine were due to peculiarities of its metabolism in different species. The sharpest species differences were detected in an evaluation of the increase in nonprotein disulfide compounds in the tissues of the animal species studied. This increase, evidently characterizing the level of unchanged cystamine, is more pronounced in rats. The enzymatic mechanisms of the reduction of cystamine in the mouse organism are more powerful than in rats. The different sensitivity of mice and rats to the toxic action of cystamine probably is associated with this to a substantial degree. (FRB)

22591 (ERDA-tr-31, pp 144-147) INFLUENCE OF RADIATION THERAPY ON THE DYNAMICS OF THE CHANGE IN THIOLS DURING THE DEVELOPMENT OF A MALIGNANT TUMOR. Glushchenko, N. N.; Danilov, V. S.; Kozlov, Yu. P. (Moscow State Univ.). 1974. Translated from Radiobiologiya; 14: No. 6, 909-912(1974).

In Radiobiology.

The change in the level of total, nonprotein SH groups and disulfides in tumor tissue, liver, spleen, whole blood, erythrocytes, and blood serum during the development of Pliss lymphosarcoma in rats and under the action of radiation therapy was studied. During the development of the tumor there are substantial changes in the level of thiols. The process of proliferation is accompanied by an accumulation of protein SH groups in the tumor and a substantial decrease in their concentration in other tissues. Such an accumulation of thiols in the tumor can be explained by a lowered level of oxidative processes in it, by the accumulation of reduced products in the tumor. Local irradiation of the tumor may promote the formation of radiolysis products of water, lipoperoxides, free radicals, and other products promoting the oxidation of the SH groups of proteins and low-molecular weight thiols. A single local irradiation of the tumor leads to a temporary increase in sulf-

hydryl groups in the liver and erythrocytes, although these changes are less pronounced in the blood and blood serum. (ERB)

22592 (ERDA-tr-31, pp 148-151) PROTECTIVE ACTION OF CYSTAPHOS AND MEXAMINE ON CELLS OF THE INTESTINAL EPITHELIUM OF MICE IN THE CASE OF IRRADIATION WITH FAST NEUTRONS. Simonenkova, B. A.; Monastyrskaya, B. I.; Sverdlov, A. G. (Leningrad Inst. of Nuclear Physics). 1974. Translated from Radiobiologiya; 14: No. 6, 912-915(1974).

In Radiobiology.

The change in the activity of alkaline phosphatase of the epithelial cells of the villi, changes in the cell population and mitotic index in crypts of the small intestine of mice after irradiation with fast neutrons at the minimum absolutely lethal dose and the influence on these indices of protectors--cystaphos and mexamine, characterized by a different (according to the criterion of survival of the animals) protective action in the case of neutron irradiation were studied. The reproductive activity in the crypts of the small intestine after a sharp drop observable during the first two days after irradiation reaches values significantly exceeding the control level by the moment of death of the animal. The increase in the activity of alkaline phosphatase 5 hrs after irradiation in the epithelium on the villi and in the mouth of the crypts is replaced by a drop in the activity of the enzyme after 24 hrs, all the way up to complete disappearance on the fourth day. Cystaphos substantially increases the reproductive function of the cells. For mexamine this effect is less pronounced and develops later. The investigated radioprotectors had no influence on the dynamics of the morphological changes in the epithelium of the villi after irradiation, as well as on the dynamics of the change in the activity of alkaline phosphatase in the course of the development of the intestinal syndrome. (ERB)

22593 (ERDA-tr-31, pp 152-157) PERMEABILITY OF THE CELL MEMBRANES OF THE MUCOSA OF THE SMALL INTESTINE AND THEIR ATPASE ACTIVITY IN THE PRESENCE OF VITAMIN A DEFICIENCY AND IRRADIATION. Leutskii, K. M.; Baran, M. M. (Chernov'tsy State Univ., USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 915-918(1974).

In Radiobiology.

The joint action of A-avitaminosis and x irradiation on the permeability of the cell membranes of the mucosa of the small intestine, the intracellular distribution of electrolytes and water, and the activity of ATPases in the mucosa and its membranes were studied in rats. It was found that irradiation at a dose of 200 R leads to an increase in the permeability of the cell membranes. A-avitaminosis aggravates these changes and leads to an increase in the permeability by 48.3 percent. Under the joint action of the factors studied the extra-intracellular transmembrane gradient of Na was lowered by 33.4 percent, and in the intra-extracellular transmembrane gradient of K by 11.1 percent. Under this joint action, the extracellular water content increased by 54.7 percent, while the intracellular water content decreased by 33.1 percent compared to irradiated controls. A lowering of the activity level of transport ATPase in the membranes is accompanied by a disruption of the permeability of the membranes under the joint action, as well as a disruption of the activity of the pump. The data obtained confirm the aggravating effect of vitamin A deficiency on the effects of x irradiation. This is probably a result of the inactivation of active transport in the membranes of the mucosa of the small intestine. (ERB)

22594 (ERDA-tr-31, pp 158-161) INVESTIGATION OF THE ACTION OF RADIOPROTECTORS ON RABBIT SPERMATOZOA IN VITRO. Nizhnik, G. V. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 919-921(1974).

In Radiobiology.

The effectiveness of AET, MEA, gammaphos, and 5-methoxytryptamine (5-MOT) in protecting rabbit spermatozoa from the effects of gamma rays in vitro was studied. The criterion for effectiveness was survival of the embryos after insemination of females with irradiated spermatozoa. Irradiation of the spermatozoa at a dose of 800 R with and without protectors did not disrupt the process of fertilization of the ova. Prenatal losses occurred primarily at the preimplantation stage. These were due to dominant lethal mutations in the spermatozoa. Not one of the indicated radioprotectors had a protective effect in the rabbit spermatozoa. In all cases, the protectors exhibited a sensitizing action. (ERB)

22595 (ERDA-tr-31, pp 162-164) MITOTIC CYCLE OF RADIOSENSITIVE AND RADIORESISTANT SUBLINES OF EHRLICH'S ASCITES CARCINOMA. Efimov, M. L.; Kleinbok, T. S. (Kazakh Inst. of Oncology and Radiology, Alma-Ata, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 922-923(1974).

In Radiobiology.

The results of a study of the relationship between the duration of the mitotic cycle and the radiosensitivity in two variants of Ehrlich's ascites carcinoma, differing in radioresistance are presented. The increase in the radioresistance of Ehrlich's ascites carcinoma as a result of repeated irradiation is accompanied not only by changes in the chromosome sets, in the content of sulfhydryl groups, and other changes, but also by a shortening of the mitotic cycle. Cells of the radioresistant variant of the tumor divided 3.7 hours more rapidly than cells of the initial radiosensitive carcinoma. (ERB)

22596 (ERDA-tr-31, pp 165-167) INFLUENCE OF HUMORAL FACTORS FROM THE CALF THYMUS ON THE IMMUNOLOGICAL STATUS AND PROCESSES OF HEMATOGENESIS OF THE IRRADIATED ORGANISM. II. Synthesis of Antibodies for Bacteriophage T2 Under the Influence of the Factor From the Thymus (FT-3); Administered to Rats After Irradiation. Skobel'tsyna, E. S.; Vasil'chenko, V. N.; Grinberg, S. M.; Samuleva, S. V. (Kharkov Scientific-Research Inst. of Medical Radiology, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 924-925(1974).

In Radiobiology.

The results of a study of the action of thymus factor (FT-3), administered after irradiation, on the synthesis of antibodies for bacteriophage T2 in rats immunized one day after irradiation are presented. The data indicate that FT-3, which evidently accelerates the repair processes in the lymphoid tissue of irradiated animals, promotes a more rapid and complete restoration of the immunobiological reactivity of the irradiated organism and, like other partially purified extracts from the thymus, substantially stimulates the biosynthesis of antibodies for thymus-dependent antigens. (ERB)

22597 (ERDA-tr-31, pp 168-171) RELATIONSHIP OF CHANGES IN THE PERIPHERAL BLOOD TO PECULIARITIES OF THE RESPONSE OF THE LYMPHOID ORGANS TO SINGLE AND FRACTIONATED NONUNIFORM IRRADIATION. Sokolova, E. N.; Pozharisskaya, T. D. (Military Medical Academy, Leningrad). 1974. Translated from Radiobiologiya; 14: No. 6, 926-927(1974).

In Radiobiology.

The constant circulation of lymphocytes in the organism may be responsible for the different reaction of the lymphoid organs to single and fractionated influence under conditions of nonuniform irradiation. In connection with this, in experiments on 130 noninbred male rats, weighing 180 to 200 g we studied the change in the number of neutrophils and lymphocytes in the peripheral blood and the dependence of the degree of lymphopenia on the degree of destruction of the lymph nodes. The anterior half of the body of the animals was irradiated once at a dose of 1500 R or fractionally, 450 R x 4, with four-day intervals between fractions. Single and fractionated irradiation produced the same death of the animals ($LD_{100/30}$). The number of leukocytes and blood formula were computed 1, 3, 5, 10, 15, 20, 25, and 30 days after irradiation and on the first and third days between fractions. It was determined that fractionated irradiation of half of the body induces a more substantial destruction of lymphoid tissue than a single irradiation at an equieffective dose with respect to mortality and close in magnitude. In the case of fractionated irradiation, each successive influence destroys lymphoid organs in the zone of irradiation and causes the death of circulating lymphocytes, which is accompanied by a decrease in the number of cells in the shielded nodes. This in all probability is responsible for the difference in the dynamics of the change in the number of peripheral blood lymphocytes in the case of single and fractionated irradiation of half the body. Fractionation of the dose of irradiation, producing a more profound destruction of the lymphoid organs, also determines the slower increase in the number of lymphocytes in the blood. However, the level of lymphocytes in the case of single and fractionated nonuniform irradiation is maintained by different types of cells. In the case of fractionated irradiation this level is due chiefly to neutrophils, which changes the ratio of neutrophils and lymphocytes of the peripheral blood characteristic of this species of animals. In the case of a single nonuniform irradiation, the usual ratio of lymphoid and neutrophil cells is preserved. (ERB)

22598 (ERDA-tr-31, pp 172-176) INFLUENCE OF DOSE FRACTIONATION ON THE SURVIVAL OF ANIMALS IRRADIATED AT VARIOUS PERIODS OF POSTNATAL ONTOGENESIS. Bogatyrev, A. V.; Timoshenko, S. I.; Sverdlov, A. G. (Leningrad Inst. of Nuclear Physics). 1974. Translated from Radiobiologiya; 14: No. 6, 928-931(1974).

In Radiobiology.

It has been established that in the case of fractionated irradiation a decrease in the injurious effect of radiation is observed, due to recovery processes occurring in the intervals between the radiation influences. And yet, the level of recovery processes depends to a substantial degree on the physiological status of the organism,

which may be associated with compensatory-adaptive mechanisms regulated by the neuroendocrine system. A study of the effect of fractionation in the case of irradiation of mice and rats at various periods of postnatal development has made it possible to reveal age peculiarities in the postradiation recovery. It has been shown that in the early periods of postnatal development, mice and rats are the least radioresistant with respect to the value of $LD_{50/30}$. It can be assumed that the high radiosensitivity of animals of this age group is due to a definite degree to imperfection of the compensatory-adaptive mechanisms in view of the immaturity of the neuroendocrine system of the organism. (ERB)

22599 (ERDA-tr-31, pp 177-179) PECULIARITIES OF RADIOSENSITIVITY ASSOCIATED WITH SEX. I. Radiosensitivity and Sexual Cycles. Alekseeva, L. V.; Kudryavtseva, A. A. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 6, 932-933(1974).

In Radiobiology.

The radiosensitivity of female mice was studied as a function of the stage of the sexual cycle. It was found that the radiosensitivity of female mice was substantially changed through the progressive phases of the sexual cycle. The most radiosensitive are the females in the proestrus and estrus. The females in diestrus and metaestrus were substantially more radioresistant. The data obtained contradict the generally accepted and widespread concepts in radiobiology of greater radioresistance of females, especially females in estrus. (ERB)

22600 (ERDA-tr-31, pp 180-183) PREDICTION OF THE HEMATOLOGICAL INDICES IN DOGS IN WHOLE-BODY CHRONIC GAMMA IRRADIATION. Popova, N. A.; Appak, N. M. 1974. Translated from Radiobiologiya; 14: No. 6, 934-936(1974).

In Radiobiology.

An attempt was made to predict the dynamics of certain indices of hematogenesis in irradiated dogs by a method based on the theory of generalized filters of Kolmogorov and Habor using an electronic computer. The parameters of the model include counts of lymphocytes, leukocytes, neutrophils, and white cells of the bone marrow. It was determined that prediction of the state of the system of hematogenesis of irradiated dogs according to the cell composition with the aid of the selected model gives satisfactory results. (ERB)

22601 (ERDA-tr-31, pp 184-188) INFLUENCE OF IONIZING RADIATION ON THE CONTENT OF RADIOACTIVE SODIUM-22 IN THE TISSUES OF CERTAIN ORGANS OF MICE. Drozd, S. S.; Burlakova, E. V.; Burdin, K. S. (Moscow State Univ.). 1974. Translated from Radiobiologiya; 14: No. 6, 936-939(1974).

In Radiobiology.

The distribution of ^{22}Na, administered intraperitoneally as NaCl, in liver, brain, muscles, and blood of x-irradiated mice was studied. It was found that immediately after irradiation at doses of 520, 720, and 1000 R the content of the isotope in the organs was increased and increased sharply up to the time of death of the animals. The accumulation of ^{22}Na in the tissues depends on the dose of irradiation; the higher the dose, the more rapid the accumulation of the isotope in the investigated tissues and organs. (ERB)

22602 (NP-20444, pp 85-87) RADIATION BIOLOGY. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

22603 ROLE OF ISOPROTERENOL IN RADIOPROTECTION AGAINST ACUTE CHANGES IN THE RAT PAROTID GLAND. Hall, H. D. (Veterans Administration Hospital, Nashville). J. Oral Surg.; 32: No. 9, 665-670(Sep 1974).

Studies in male rats showed that the radioprotection of parotid gland induced by isoproterenol is associated with cell replication and not with polyploidy. The protection is associated with a specific point in the generation cycle. Evidence indicates that this point is the interval of DNA synthesis. (auth)

22604 RADIOSENSITIVITY OF T AND B LYMPHOCYTES IN MICE. Kataoka, Y.; Sado, T. (National Inst. of Radiological Sciences, Chiba, Japan). Immunology; 29: No. 1, 121-130(Jul 1975).

The radiosensitivity of T and B lymphocytes in spleens of specific pathogen-free C3Hf/HeMs male mice was studied by the direct and indirect immunofluorescence technique. It was found that the radiobiological parameters characterizing the survival curve of B_Y lymphocytes were D_o = 200 R and n = 1.00. The T lymphocytes, on the other hand, were shown to consist of two distinct sub-populations with respect to their radiosensitivity. The radiobiological parameters of the radiosensitive fraction of T lymphocytes were D_q = 185 R, D_o = 195 R and n = 2.50. The D_o value of the radioresistant T lymphocyte subpopulation was practically unmeasurable. It was estimated that approximately 8% of the T lymphocytes present in the spleen of normal C3Hf mice belonged to this radioresistant subpopulation. (auth)

22605 TIME/DOSE RELATIONSHIPS IN ABDOMINAL IRRADIATION: A DEFINITION OF PRINCIPLES AND EXPERIMENTAL EVALUATION. Hagemann, R. F.; Concannon, J. P. (Allegheny General Hospital, Pittsburgh). Br. J. Radiol.; 48: No. 571, 545-555(Jul 1975).

The work of numerous investigators has been drawn upon to formulate a model describing the principles governing the acute response of the intestinal epithelium to cytotoxic agents. Tolerance (exposure required to kill 50% of the animals) to abdomen-only irradiation was measured experimentally in the mouse using a total of 17 time/dose fractionation schedules. The principal determinants of intestinal response to fractionated radiation therapy were magnitude of each fraction and the introduction of regular recovery intervals during the course of treatment. The roles of exposure per week, exposures per day, and radiation days per week were also examined. The log-log plots of endpoint v. either number of fractions or overall treatment time yielded straight lines with slopes of 0.54 and 0.59 and y intercepts of 1,270 and 812 rets respectively. The single dose for 50% acute intestinal lethality ($LD_{50/6}$ days) was 1,610 R. It would appear that the acute intestinal tolerance to fractionated irradiation is, in the mouse, extremely dependent upon fraction number and overall treatment time. The biological basis for intestinal tolerance to cytotoxic agents is discussed in light of the results of these studies and the model initially described. (auth)

22606 IRRADIATION OF MOUSE BRAIN: EFFECTS ON INCORPORATION OF TYROSINE-^{14}C INTO CATECHOLAMINES IN VIVO AND ON UPTAKE OF NE-^{14}C BY BRAIN SLICES IN VITRO. Hsu, L. L.; Samorajski, T. (Cleveland Psychiatric Inst.). Neurobiology; 4: 419-424(1974).

The short-term and long-term effects of deuteron irradiation are examined with regard to the rates of incorporation of tyrosine-^{14}C into catecholamines in the mouse brain. Groups of mice received doses of 5 K, 10 K, 15 K, or 20 K rad covering an area of 9 × 5 mm over the parietal, visual, and cerebellar cortex and extending to a depth of 2 mm from the skull. At 12 days, 40 days, or 12.5 months after irradiation 0.25 μCi of tyrosine-^{14}C was injected intracerebrally, and the animals were sacrificed 20 minutes after injection. Measurement of the endogenous NE content in the mouse brain indicated a decrease in NE level 40 days and 12.5 months after irradiation at 20 K rad. However, the rate of incorporation of tyrosine-^{14}C into catecholamines was increased with increasing doses of irradiation and peaked at 10 K rad. Results were consistent with all three groups of mice receiving the irradiation. Furthermore, within each dose range the group injected with tyrosine-^{14}C 40 days after irradiation showed the highest rate of incorporation. A different group of mice was sacrificed 60 days after receiving 5 K or 15 K rad or sham irradiation, and the uptake of NE-^{14}C in brain slices was studied. Results indicated that slices from brains irradiated at 15 K rad showed the highest uptake of NE-^{14}C. (auth)

22607 THERMOSTABILITY OF THE BLOOD SERUM IN DOGS EXPOSED TO A COMBINED EFFECT OF X IRRADIATION AND REDUCED BAROMETRIC PRESSURE. Vashuk, A. A. Kosm. Biol. Med.; 8: No. 3, 88-90(May 1974). (In Russian).

For English translation see the Journal Environ. Space Sci.

In dogs which were subjected to the effects of reduced pressure in addition to irradiation at doses of 100, 350, and 700 R, the increase of the thermostability of the blood serum was much sharper than in dogs exposed to irradiation alone. In the combined treatment, the clinical signs of radiation sickness were very clear. The increase of the thermal stability of blood serum after irradiation is possibly connected with the changes occurring in the albumin according to the type of denatured stabilization. This in turn indicated the decrease of the lability of the albumin molecule and the decrease of the functional state of the albumin and many systems of the organism. (tr-INIS)

22608 MUTATION INDUCTION IN MICE. Searle, A. G. (Medical Research Council, Harwell, Eng.). Adv. Radiat. Biol.; 4: 131-207(1974).

Data are reviewed from studies on the induction of mutations in mice following exposure of spermatogonial stem cells or follicular oocytes to various doses and dose rates of x radiation, gamma radiation, or fission neutrons. (250 references) (CH)

22609 EXPERIMENTAL RADIATION CARCINOGENESIS. Walburg, H. E. Jr. (Oak Ridge National Lab., TN). Adv. Radiat. Biol.; 4: 209-254(1974).

Literature on radioinduced carcinogenesis in experimental animals is reviewed with emphasis on the basic principles which could lead to a better predictability of radiation effects in man. It was concluded that the animal systems studied thus far are

quantitatively inadequate for determining radiation risk estimates in man, (350 references) (CH)

22610 HIPPOCAMPAL DEVELOPMENT IN THE RAT: CYTOGENESIS AND MORPHOGENESIS EXAMINED WITH AUTORADIOGRAPHY AND LOW-LEVEL X-IRRADIATION. Bayer, S. A.; Altman, J. (Purdue Univ., Lafayette, IN). J. Comp. Neurol.; 158: No. 1, 55-79(1 Nov 1974).

The cytogenesis and morphogenesis of the rat hippocampus was examined with the techniques of ^{3}H-thymidine autoradiography, cell pyknosis produced by low-level x-irradiation, and quantitative histology. The procedure of progressively delayed cumulative labelling was used for autoradiography. Groups of rats were injected with four successive daily doses of ^{3}H-thymidine during non-overlapping periods ranging from birth to day 19. They were killed at 60 days of age, and the percentage of labelled cells was determined. Cell pyknosis in Ammon's horn reaches a maximal level prenatally and declines rapidly during the early postnatal period. Cell pyknosis in the dentate gyrus reaches its highest level during the second postnatal week and declines gradually with some radiosensitive cells still present in the adult. Immature granule cells are also at their highest level during the second postnatal week, while mature granule cells gradually accumulate to attain asymptotic levels at around two months of age. The alignment of the pyramidal cells to form the characteristic curvature of Ammon's horn occurs shortly after pyramidal cell cytogenesis is completed. Mechanisms for the morphological development of the dentate gyrus along with a consideration of the possible migratory route of granule cell precursors are discussed. (auth)

22611 TERATOGENIC AND EMBRYOLETHAL EFFECTS IN MICE OF FISSION-SPECTRUM NEUTRONS AND gamma-RAYS. Cairnie, A. B.; Grahn, D.; Rayburn, H. B.; Williamson, F. S; Brown, R. J. (Queen's Univ., Kingston, Ontario). Teratology; 10: No. 2, 133-139(Oct 1974).

Fission-spectrum neutrons from the Janus reactor at Argonne National Laboratory were compared with gamma-rays in terms of their relative biological effectiveness (RBE) for embryolethal and teratogenic effects in mice. No evidence was found of any processes that were abnormally sensitive to neutrons. The RBE for killing embryos and producing abnormal embryos or specific abnormalities was between 2 and 3. This is close to the values found in other systems for processes involving cell killing. (auth)

22612 BEHAVIOR OF THE RAT MANDIBLE AFTER MAXIMUM X-RAY IRRADIATION IN THE CASE OF ADMINISTRATION OF VENORUTON AND RONICOL. Bierbaum, H. U. Munich; Univ. Munich (1972). 54p. (In German). INIS.

Thesis.

Eight-week-old albino rats were irradiated during general anesthesia with X-rays. Each animal received a total dose of 5,700 R, the weekly fraction amounting to 950 R. Afterwards the animals were sacrificed and the mandible removed and decalcified. Histological sections of 12-15 μ were prepared by means of a microtome. In the case of administration of Venoruton, osteoradionecroses occurred only to a small extent while Ronicol protected the animals completely from osteoradionecrosis. (GE)

22613 FACTORS INFLUENCING CLASMATOSIS IN VIVO. VI. Circadian Rhythm. Kabakov, E. N. (Research Inst. of Medical Radiology, Obninsk, USSR). Stud. Biophys.; 47: No. 3, 183-189(1974). (In Russian).

Clasmatosis of lymphoid cells in lymphatic nodes of intact rats determined by two quantitative criterions is changing rhythmically within 24 hours having maximal levels at 9.00 and 24.00 and minimal levels at 6.00 and 15.00. This new manifestation of circadian rhythm is discussed in the connection with the hormonal control of cytodifferentiation in lymphoid tissue and changes of radiosensitivity. (auth)

22614 MECHANISMS AND INTERACTIONS IN TESTICULAR STEROIDOGENESIS AND PROSTAGLANDIN SYNTHESIS. Ellis, L. C.; Sorenson, D. K.; Buhrley, L. E. (Utah State Univ., Logan). J. Steroid Biochem.; 6: No. 6, 1080-1090(Jun 1975).

Prostaglandin synthesis by rat testicular tissue was observed to be gonadotrophin and adrenal dependent, and to have the same distribution in the gonad as the steroidogenic enzymes. The synthesis was increased by 5-HT, but decreased by melatonin. Lipid peroxidation increases with age, FSH treatment, linoleic and arachidonic acid, and melatonin, but was decreased by serotonin, c-AMP, LH, prolactin, and epinephrine. Testicular lysosomes were labilized by LH, adrenal demedullation, testosterone, Vit. A, and acetylcholine, but were stabilized by c-AMP, epinephrine, and cortisol. Contractility of rat seminiferous tubules was observed to be prostaglandin dependent, stimulated by 5-HT, and inhibited by melatonin and c-AMP. Evidence was obtained indicating that a phospholipase A_2 is present in rat testicular lysosomes, and that it is liberated by radiation, heat, or certain chemicals. This enzyme hydrolyses PUFA from membrane phospholipids, the former of which are converted into prostaglandins. The prostaglandins appear to initially stimulate contractility of seminiferous tubules, but at higher concentrations they stimulate adenyl cyclase, which increases c-AMP levels in the tubules thereby inhibiting contractility and cellular division. The process of prostaglandins synthesis also produced malonaldehyde, and endoperoxides that contribute to alterations in steroidogenesis by Schiff's base formation and to cellular lysis by membrane permeability changes. Prostaglandins appear to be synthesized physiologically from PUFA derived from cholesterol esters, but pathologically in much larger quantities from membrane phospholipids. Prostaglandins apparently inhibit androgen synthesis by their effects on cholesterol esterase and other steroidogenic enzymes rather than by changing blood flow. (auth)

22615 EFFECT OF OLEATE PRETREATMENT ON [^{14}C]GLYCINE INCORPORATION INTO PLASMA PROTEINS IN X-IRRADIATED RATS. Nadkarni, G. D. (Bhabha Atomic Research Centre, Bombay). Indian J. Biochem. Biophys.; 14: No. 2, 138-140(Jun 1974).

Intraperitoneal injection of 1.0 ml (850 mg) of ethyl oleate to 200 to 250 g rats, 20 hr prior to 800 R whole-body x irradiation, caused 91% increase in the relative [^{14}C]glycine incorporation into albumin at 6 days, post-irradiation compared to untreated-irradiated rats. There were, however, no significant changes in the concentrations of albumin, fibrinogen, and total proteins. Precursor incorporation into fibrinogen showed a significant rise only at 4 days compared to untreated rats. These manifestations may be a part of the recovery processes in irradiated rats which have been pretreated with oleate. The possible mechanisms of action of oleate have been discussed. (auth)

22616 SEXUAL FUNCTION OF MICE SUBJECTED TO IRRADIATION MODELLING X-RAY EXAMINATION. Koroleva, T. M.; Lisenkova, L. N. (Leningrad Scientific-Research Inst. for Radiation Hygiene). Gig. Sanit.; No. 2, 53-56(Feb 1975). (In Russian).

Three local irradiations of albino mice of two successive generations in a dose ($25 \times 3 = 75$R), that was modelling conditions prevailing at multiple x-ray examinations of the pelvic region, produced an increase of sterility of females. The irradiation of the mice of the first generation proved to influence the sterilizing effect of the irradiation of the second generation. (auth)

22617 ROLE OF LYMPHOID AND BONE MARROW HEMOPOIETIC TISSUES IN INTERFERON PRODUCTION IN AN IRRADIATED ORGANISM. Lvovskii, E. A.; Shimanovskii, A. D.; Kiselev, P. N.; Livshits, R. E.; Ponomareva, T. V.; Kolotvin, V. A.; Nevstrueva, M. A. (Inst. of Virology, Moscow). Vop. Virusol.; 5: 564-568(1974). (In Russian).

The experiments showed that accumulation of ^{90}Sr in the bone tissue led to inhibition of endotoxin induced interferon correlating with the state of the bone marrow hemopoiesis. Appearance of myeloid hemopoiesis foci in the spleen was accompanied by partial restoration of the capacity of animals to produce interferon in response to E. coli endotoxin. The external irradiation with 300 and 600 R inhibited virus induced interferon production more strongly. In these cases there was a correlation with the condition of the spleen lymphoid tissue. It is concluded on the basis of the evidence obtained that the bone marrow hemopoietic tissue takes more part in the endotoxin induced interferon production in irradiated animals. (auth)

22618 CLONING OF STEM CELLS IN THE BONE MARROW OF IRRADIATED MICE. Shvets, V. N. (Scientific-Research Inst. of Medical Radiology, Obninsk, USSR). Byull. Eksp. Biol. Med.; 79: No. 5, 40-44(May 1975). (In Russian).

Different amount of intact or irradiated bone marrow from syngenous donors was administered to mice irradiated with a lethal dose. There was revealed a linear dependence of the number of the 8 to 9-day colonies grown in the bone marrow of the femur on the amount of the administered cells, and an exponential dependence on the irradiation dose. Regularity of the stem cell cloning in the bone marrow was analogous to such in the spleen. Radiosensitivity of the colony-forming units (CFU) differed depending on the site (the spleen, the bone marrow) of their colony formation. The CFU settling in the marrow proved to be more radioresistant (D_0 equalled 160 to 200 R) in comparison with the CFU settling in the spleen (D_0 constituted 80 to 100 R). It is supposed that a different radiosensitivity of the CFU was caused by the presence of heterogenic population of the stem cells and also by specific peculiarities of the organ (the spleen, the bone marrow) in which the colonies formed. (auth)

22619 RESTORATION OF OSTEOGENIC PROPERTIES OF THE BONE MARROW FOLLOWING IRRADIATION ACCORDING TO THE DATA OF HETEROTOPIC TRANSPLANTATION. Kura-

lesova, A. I. (Inst. of Epidemiology and Microbiology, Moscow). Byull. Eksp. Biol. Med.; 79: No. 5, 111-114(May 1975). (In Russian).

It was found that bone marrow obtained from the tibium or the femur (locally irradiated with 2000 R) and transplanted subcapsularly into the kidney of mice of the same strain 0 to 4 months after the irradiation was always resorpted. As to the bone marrow from the nonirradiated bones of the same donors — it always possessed osteogenic potencies. Stroma of the irradiated limb was defective and failed to regenerate at the expense of repopulation of the stroma elements from the nonirradiated sections. Analogous conclusions were drawn on the basis of the experimental results with repeated irradiation of mice with the shielded extremity. In difference to the hemopoietic, stromal elements were incapable of repopulation (according to the data of heterotopic transplantation. (auth)

22620 EFFECT OF WHOLE-BODY X IRRADIATION ON LYSOSOMAL ENZYMES. D'Souza, D. W.; Vakil, U. K.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). Indian J. Biochem. Biophys.; 11: No. 2, 97-101(Jun 1974).

Effects of whole-body x irradiation with sublethal dose (400 rad) on three intestinal lysosomal enzymes, namely arylsulphatase, cathepsin, and acid phosphatases, have been studied. They are almost equally distributed throughout the entire small intestine region. X irradiation adversely affects the integrity of lysosomal membranes. Free and total lysosomal enzyme activities exhibit maxima on the 6th day. These activities return to normal level on the 14th day when there is rapid regeneration of villi, indicating that lysosomal activities correlate with the progression of injury and of repair mechanism after sublethal dose of x irradiation. The increase in total lysosomal activity may be due to its decreased breakdown, since the rate of protein synthesis in intestinal mucosa is reduced. This is evidenced by reduced incorporation of orally fed [^{14}C]leucine into acid insoluble proteins. (auth)

22621 CHANGES OF SUBCOMMISSURAL ORGAN IN IRRADIATION SYNDROME. Miline, R.; Devecerski, V.; Dedic, M.; Miline, J. (Clinical Hospital, Novi Sad, Yugoslavia). Endocrinol. Exp.; 8: No. 4, 299-309(1974).

In mature rats individually irradiated by lethal dose of 800 R and sacrificed 72 hr after irradiation, the following changes were found in the structure of the subcommissural organ (SCO): hypertrophy of nuclei in ependymocytes and hypendymocytes; increased activity of alkaline and acid phosphatase, DPNH-diaphorase, non-specific esterase, and succinodehydrogenase: polymorphism of ependymocytes nuclei, enlargement of perinuclear space and occurrence of cisternae of endoplasmic reticulum, numerous secretory granules in both poles of ependymocytes, hypertrophy of the Golgi zone, hypertrophy of mitochondria in hypendymocytes, increase in number of secretory granules and of primary and secondary lysosomes, occurrence of intracytoplasmic cavities with discharge of their content into intercellular spaces and confrontation with periodic structural bodies, and presence of numerous vesicles within the endings of amyelinic fibres. These changes presumably show the progressive reaction and active role of SCO in maintenance of the disturbed hydromineral balance in irradiation syndrome. (auth)

22622 LUCHEV'IE DERMATITY. (Radiation Dermatitis). Sosnovskii, A. T. Minsk; Izdatel'stvo belarus' (1974). 144p. (In Russian).

The principles concerning radiation injury to the skin and the conditions under which such injuries occur are analyzed. The use of new anti-inflammation substances for the therapy of radiation dermatitis is discussed. The changes in the ultrastructure of the skin cells induced by x radiation and other types of radiation are discussed. Both animal experimental studies and clinical research are reported. An extensive bibliography is appended. (JSR)

22623 EFFECT OF HEAT AND IONIZING RADIATION ON NORMAL AND NEOPLASTIC TISSUE OF THE C3H MOUSE. Thrall, D. E.; Gillette, E. L.; Dewey, W. C. (Colorado State Univ., Fort Collins). Radiat. Res.; 63: No. 2, 363-377(Aug 1975).

The radiation response of the skin of the C3H mouse was evaluated in terms of the dose of radiation required to produce moist desquamation completely surrounding the lower aspect of the hind leg by 21 days following irradiation (DD50-21). Irradiation of the leg under various conditions of local tissue oxygenation indicated that when the animals were breathing air (ambient conditions), the cells in the skin were not fully oxygenated. Heat was administered by immersing the leg for 15 min in 44.5°C water either immediately prior to or immediately following irradiation under various conditions of local tissue oxygenation. Heat administered following irradiation reduced the DD50-21 values by 724 rad for hyperbaric O_2, 1210 rad for ambient, and 1656 rad for hypoxic conditions. Approximately these same rad equivalents were observed when heat was administered prior to irradiation, under hyperbaric O_2 and hypoxic conditions. However, administration of heat prior to irradiation under ambient conditions sensitized the cells to the effects of ionizing radiation. This sensitization was assumed to result from heat causing an increase in local tissue oxygenation prior to and at the time of irradiation. The effect of the heat dose administered under acute hypoxic conditions immediately prior to acute hypoxic irradiation was not significantly different from the protocol where heat was administered under ambient conditions immediately prior to acute hypoxic irradiation. This indicates an independence of the magnitude of the heat effect on the tissue oxygenation status at the time of heating. The response of the C3H mouse mammary adenocarcinoma to combined wet heat (DELTA) and x radiation (X) administered under either hypoxic, ambient, or hyperbaric O_2 conditions of local tissue oxygenation was studied. (auth)

22624 POSTIRRADIATION REGENERATION OF INTESTINAL EPITHELIUM IN W/W/sup v/ AND Sl/Sl/sup d/ GENETICALLY ANEMIC MICE. Hopper, A. F.; Russell, E. S. (Rutgers-The State Univ., New Brunswick, NJ). Radiat. Res.; 63: No. 2, 310-319(Aug 1975).

Not all rapidly proliferating tissues of the mouse are adversely affected by action of mutant alleles at the W- and Sl loci. In contrast to greatly impeded proliferation of blood-cell precursors, primordial germ cells, and melanocyte precursors in W/W/sup v/ and Sl/Sl/sup d/ anemic, sterile, black-eyed white mice, normal proliferation of intestinal mucosa was observed in mice of these same genotypes. Determinations of number of cells per intestinal crypt, labeling index, mitotic index, and uptake of tritiated thymidine per mg of mucosa, showed no significant differences between values for untreated normal (+/+) and anemic (W/W/sup v/ and Sl/Sl/sup d) mice. The intestinal mucosa of the W/W/sup v/ and Sl/Sl/sup d/ mice responded to radiation insult in the same manner as did that of +/+ mice. Mice of all three genotypes were equally able to increase proliferative activity in the crypts, and to restore normal cell numbers. Differences between these findings and other recent studies are discussed. (auth)

22625 BIOLOGICAL ALTERATIONS RESULTING FROM CHRONIC LUNG IRRADIATION. II. Connective Tissue Alterations Following Inhalation of ^{144}Ce Fused Clay Aerosol in Beagle Dogs. Pickrell, J. A.; Harris, D. V.; Pfleger, R. C.; Benjamin, S. A.; Belasich, J. J.; Jones, R. K.; McClellan, R. O. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Radiat. Res.; 63: No. 2, 299-309(Aug 1975).

Beagle dogs were exposed by inhalation to an aerosol of ^{144}Ce clay to quantitate the relationship between pulmonary radiation dose and induced fibrosis. Collagen, elastin, glucosamine, and the ratios of elastin/collagen, hydroxyproline/hydroxylysine, and hydroxyproline/proline were determined to indicate changes in connective tissue constituents. Total lung collagen was partitioned into native collagen, soluble collagen, and ultrafilterable hydroxyproline peptides. Increased total lung collagen correlated best with increasing cumulative radiation dose and increasing time after inhalation exposure. The increase in total lung collagen was not seen until more than 4 mo after exposure and a cumulative dose of about 40,000 rad. Soluble collagen and low molecular weight hydroxyproline peptide quantities both increased at 2 mo after exposure and cumulative doses of 20,000 to 27,000 rad. A variable elastin response apparently was not related to either increasing time or increasing radiation dose after exposure. These results indicate that collagen accumulation is an important factor in pulmonary fibrosis. Although collagen synthesis and breakdown were both activated at a relatively early time after inhalation, a significant increase in native collagen (scarring) occurred only when the metabolic balance was altered by protracted time or irradiation after exposure.The interrelationships observed in this study provide insight into the mechanism of fibrosis induced by chronic pulmonary injury. (auth)

22626 BIOLOGICAL ALTERATIONS RESULTING FROM CHRONIC LUNG IRRADIATION. I. The Pulmonary Lipid Composition, Physiology, and Pathology After Inhalation by Beagle Dogs of ^{144}Ce-Labeled Fused Clay Aerosols. Pfleger, R. C.; Boecker, B. B.; Redman, H. C.; Pickrell, J. A.; Mauderly, J. L.; Jones, R. K.; Benjamin, S. A.; McClellan, R. O. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Radiat. Res.; 63: No. 2, 275-298(Aug 1975).

Three groups of four beagle dogs inhaled a ^{144}Ce-labeled fused clay aerosol; two additional dogs per group, exposed to a stable cerium-labeled fused clay aerosol, were used as controls. At monthly intervals, one diaphragmatic lobe of each of two dogs exposed to ^{144}Ce and one control animal from each group was lavaged with isotonic saline. The recovered lavage solutions were centrifuged to isolate lung cells (mostly macrophages)

and surfactant for lipid analyses. The groups were sacrificed at 2, 4, and 6 mo after exposure, when the lungs of the dogs exposed to ^{144}Ce had average cumulative radiation doses of 23, 36, and 59 krad, respectively. Chronic irradiation of the lung resulted in a progressive radiation pneumonitis which was assessed clinically and pathologically at various intervals. At sacrifice, the lungs were analyzed for ^{144}Ce and the right apical and diaphragmatic lobes were minced and lyophilized and the lipids were extracted. Total lipids from all lung samples were determined gravimetrically and individual compounds were identified, isolated, and quantitated. The quantities of lipid in lung tissue, in pulmonary cells, and in surfactant increased as a function of time and radiation dose. Neutral lipids (sterol esters and triglycerides) accounted for most of the increase. (auth)

22627 STUDY OF THE EFFECT OF ULTRA-VIOLET LIGHT ON BIOMEMBRANES. V. Photolysis of Lipids and Sulfur-Containing Groups and Its Role in the Inactivation of Respiration of Isolated Mitochondria. Roshchupkin, D. I.; Marzoev, A. I.; Puchkov, E. O.; Vladimirov, Yu. A.; Khripach, L. V. (Medical State Inst., Moscow). Stud. Biophys.; 48: No. 1, 67-75(1975).

Photoinactivation of respiration of rat liver mitochondria by uv-light in its relation to photoperoxidation of lipids and photolysis of sulfhydryl and disulfide groups in mitochondrial membranes was studied. The rate of lipid photoperoxidation was estimated by measurements of accumulations of hydroperoxides (chemiluminescent assay) and final products (colour reaction with 2-thiobarbituric acid (TBA)). Concentration of thiols and disulfides was determined by fluorescent method with a sulfhydryl marker fluorescein mercury acetate. The degree of inhibition of mitochondrial respiratory chain was evaluated by analysis of oxygen consumption rate changes after uv irradiation. Hydroperoxides of lipids were shown to be formed before TBA-active product accumulation in mitochondria during irradiation by uv light in the presence of oxygen. The invacuum irradiation of the mitochondria, which previously had been treated with uv light in oxygen-containing medium, was found to destroy hydroperoxides with additional formation of final products. These data indicate that there are at least two subsequent photochemical reactions of lipids in membrane material: oxygen-dependent formation of lipid hydroperoxides; and oxygen-independent destruction of the hydroperoxides with final product formation. The second reaction was more effective in the inactivation of mitochondrial respiration. The level of the SH groups decreased and the quantity of the S-S groups increased in mitochondria after uv-irradiation with air oxygen, but after irradiation in vacuum the amount of thiols did not decrease but on the contrary tended to increase, probably due to the dissociation of disulfides. Apparently, the oxidation of thiol groups in mitochondrial membranes is the result of their interaction with some products of lipid photoperoxidation and finally brings about the inhibition of respiration in phosphorylating mitochondria. (auth)

22628 FORMIMINOGLUTAMATE EXCRETION IN RATS EXPOSED TO X RAYS AND ^{60}Co GAMMA RADIATION. Hilgertova, J.; Ostra, A.; Sonka, J. (Karlova Univ., Prague). J. Nucl. Biol. Med.; 19: No. 1, 1-4(1975).

Urinary formiminoglutamate (FIGLU) was estimated in the course of 9 postirradiation days in x-ray or ^{60}Co gamma-irradiated rats. FIGLU excretion followed in all cases a curve characterized by two peaks separated by a reversed peak. A similar pattern was also observed in ^{60}Co gamma-irradiated rats, whose FIGLU excretion was enhanced by daily histidine treatment. It is suggested that augmented FIGLU excretion results from an inhibition of repair mechanisms. The low FIGLU excretion may be considered as a sign of enhanced incorporation of one-carbon moiety. (auth)

Invertebrates

Refer also to abstract 22509.

22629 (ERDA-tr-31, pp 64-67) INDEPENDENCE OF LETHAL DAMAGE IN THE PROGENY OF IRRADIATED CELLS FROM THE RATE OF THEIR REPRODUCTION (EXPERIMENTS ON AMOEBA PROTEUS). Bychkovskaya, I. B.; Ochinskaya, G. K. (Central Scientific-Research Roentgenoradiological Inst., Leningrad). 1974. Translated from Radiobiologiya; 14: No. 6, 852-854(1974).

In Radiobiology.

Irradiated amoebas were cultured in the form of individual lines with various systems of feeding influencing the rate of reproduction of the cells. It was shown that even a substantial (almost five-fold) change in the value of the cell cycle does not influence the rate of death in the progeny of irradiated amoebas. Evidently the realization of the special hereditary damage to the cells described is not associated with any stages in the cell cycle. (tr-auth)

22630 STUDIES ON THE MATING COMPETITION OF GAMMA-IRRADIATED AND NON-IRRADIATED MALES OF MELON FRUIT FLY (DACUS CUCURBITAE). Ahmed, C. R. (Ministry of Agriculture and Works, Karachi, Pakistan). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 407-409(Jun 1975).

The comparative mating ability between sterile and normal males of melon fruit fly, Dacus cucurbitae was assessed under laboratory conditions. Seven-day old pupae of melon fruit fly were exposed to γ radiation at a dose of 9.0 kR. Both γ-irradiated and non-irradiated males were crossed with normal virgin females at the ratios of 0:1:1, 2:1:1, 5:1:1, 7:1:1, 9:1:1, 11:1:1, 12:1:1, 13:1:1, and 14:1:1 and the percentages of viable eggs obtained at these ratios were 83.5, 45.0, 32.4, 23.1, 14.5, 7.4, 4.5, 1.5, and 0.0% respectively. (auth)

22631 EFFECT OF GAMMA RAYS ON TRICHOMONAS GALLINARUM, MARTIN, ROBERTSON, 1911. Stefanova, M. (Veterinary Inst., Stara Zagora, Bulgaria). Vet. Med. Nauki (Sofia); 10: 39-45(1973). (In Bulgarian).

Radiometric and cultural studies were carried out to follow up the changes in the reproductive capacity in vitro and the infectivity in vivo of Trichomonas gallinarum (in the viscera of experimentally infected birds). Trichomonas organisms were labelled with radioactive phosphorus, and gamma-ray treatment was effected by means of a GUBE-4000 device (1350 R/min.) at rates of 40 to 300 kR. It was found that the reproductive capacity of Tr. gallinarum is not affected by gamma treatment within the range of 40 to 160 kR. At 180 kR and up to 300 kR, it progressively lowers and disappears at the final rate. Rates of about 100 kR prove most instrumental in retaining of both the reproductive capacity in vitro and the infectivity in vivo. (auth)

22632 SENSITIVITY OF ADULT AND EMBRYONIC CALANOID COPEPODS TO ACUTE IONIZING RADIATION. Gehrs, C. W.; Trabalka, J. R.; Bardill, E. A. (Oak Ridge National Lab., TN). Radiat. Res.; 63: No. 2, 382-385(Aug 1975).

Effects of ^{60}Co gamma-rays on adult and embryonic calanoid copepods (Diaptomus clavipes Schact) were determined following acute doses of 0, 1, 10, and 100 krads. Mean survivorship of adults ranged from 3.1 to 45.2 days (100 krad and controls, respectively) and decreased significantly at each increase in dose. The 100-krad dose effected 100 percent mortality to all embryos. Whereas all clutches in the controls had some hatching success, a progressive increase in percentage of clutches in which no hatching took place was seen over the dose range used. Nearly twice as many clutches were dropped in the irradiated group as in the controls. While a significant decrease in hatching success with increasing dose was observed when all clutches were compared, this was not the case at the lowest dose for carried clutches. Possibly the females are able to assess the physiological state of the embryos carried and eject clutches containing damaged eggs. (auth)

22633 NONCYTOKINETIC INJURY: SPARING EFFECT OF DOSE FRACTIONATION FOR DELAY OF PUPARIATION OF THE FLESHFLY, SARCOPHAGA BULLATA PARKER. Hagan, M. P.; Ducoff, H. S. (Univ. of Illinois, Urbana). Radiat. Res.; 63: No. 2, 378-381(Aug 1975).

Pupariation delay after irradiation of larvae of dipterous insects represents a precisely measurable form of noncytokinetic injury. A sparing effect of dose fractionation was demonstrated for this phenomenon. Sarcophaga bullata Parker were irradiated during the precritical period of the last larval instar. Pupariation delay is a function of dose from 1400 R to 4200 R; a sparing effect of dose fractionation was demonstrable over this entire range of doses. (auth)

22634 MAJOR DIFFERENCES IN THE FREQUENCIES OF RADIATION-INDUCED MALFORMATIONS AND EYE COLOR MUTANTS IN MATURE OOCYTES OF THE WASP DAHLBOMINUS. Baldwin, W. F.; Knight, P. A. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiat. Res.; 63: No. 2, 320-325(Aug 1975).

A comparison of the effects of gamma radiation over the range of exposures from 15.5 to 125 R on the production of malformations and eye color mutations in mature oocytes of Dahlbominus revealed several major differences in the two sorts of response. At all exposures, total malformations of all sorts appeared in larger numbers than eye color mutants, and the doubling dose for malformations was at least six times higher. It was concluded that the majority of the induced malformations in Dahlbominus may arise by a process other than point mutation, e.g., through nondisjunction, and that the genetic hazard from low doses for this type of injury will not be severe. (auth)

22635 CHROMOSOMAL STUDIES DURING SPERMATOGENESIS AND THE RADIATION INDUCED CHROMOSOMAL ABERRATIONS IN BIOMPHALARIA GLABRATA. Narang, N.; Narang, S. Rev. Brasil. Pesquis. Med. Biol.; 7: No. 4, 419-425(1974).

Morphology and behavior of chromosomes during spermatogenesis of SL strain of Biomphalaria glabrata has been described. No zygotene stage was observed. Heteropycnosis as well as bridges were also absent. Eight to ten day old snails were irradiated in the range of 3000 to 5000 R. Ovotestes were squashed soon after the radiated snails laid the eggs. First and second filial generations were also checked for the induced chromosomal aberrations. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 22273, 22274, 22650, and 22695.

22636 (CONF-7305119-(Absts)) 3RD NATIONAL SYMPOSIUM ON RADIOLOGICAL DOSIMETRY, JACHYMOV, CZECHOSLOVAKIA, MAY 1973. Abstracts. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1973. 153p. (In Czech).

Abstracts are presented of the 139 papers on radiation dosimetry presented at this symposium. Methods used for measurements of the radiation dose to man from both external and internal sources are described. (CH)

22637 (LBL-3388) THREE DIMENSIONAL IMAGE RECONSTRUCTION USING PINHOLE ARRAYS. Chang, L. T.; Macdonald, B.; Perez-Mendez, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 10 Feb 1975. Contract W-7405-eng-48. 4p. (CONF-750426-2). Dep. NTIS $4.00.

From international optical computing conference; Washington, District of Columbia, USA (23 Apr 1975).

From multiple single-pinhole exposures of a three dimensional object, taken with a position-sensitive gamma-ray detector, tomographic images of radionuclide distribution in patients during diagnostic tests are formed with the aid of a computer. The effects of obscuring, offplane activity are removed for a number of transverse planes through the object in a three dimensional image reconstruction method which uses the tomographic images as input. Lateral resolution, detector counting rate, total exposure times, and statistical accuracy of the final image are comparable to those of the single pinhole camera. The mathematical technique of the reconstruction method is applicable to images produced by a number of tomographic imaging devices. (auth)

22638 (LIB/Trans-577) ORIENTED HEMOLYSIS OF THE RED BLOOD CELLS OF MINERS FROM URANIUM MINES. Nosek, J. Translated from Cesk. Fysiol.; 18: 449-453(1969). 10p. Dep. NTIS (US Sales Only) $4.00.

The method of orientated hemolysis was used to investigate suspensions of washed red blood cells. The control group and the test group from uranium miners were compared. It was found that the groups did not differ either in the number of the test tubes where hemolysis took place, or in the number of the hemolytic zones. However they did differ in the average width of the hemolytic zones and their most probable location. A more frequent occurrence of wide hemolytic zones and their placement at the end of a row of 40 test tubes was observed in the cells from uranium miners. The reason for this was not elucidated but it was shown that the phenomenon could be simulated artifically by adding uranyl and lead salts to the suspension of the red blood cells. (auth)

22639 (ORNL-TM-4916) MEASUREMENTS OF ABSORBED FRACTIONS AS A FUNCTION OF SOURCE ORGAN SIZE FOR SELECTED SOURCE ORGANS IN A HETEROGENEOUS PHANTOM. Mei, D. N. H.; Stansbury, P. S.; Warner, G. G.; Poston, J. W. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. 100p. Dep. NTIS $8.00.

Thesis. Submitted by N. H. Mei to the Univ. of Tennessee, Knoxville.

Measurements of the absorbed radiation dose fractions were made in a representation of an adult human. The primary purpose of this research was to investigate the effect of source organ size on the absorbed fractions in many target organs in the body. For the bladder and the stomach five sizes were chosen to represent the various stages of filling. Polystyrene shells for each size of each organ were designed, fabricated, and filled with radioactive solutions. The set of stomach source organs was filled with ^{137}Cs. The bladders were filled twice. First they were filled with ^{137}Cs and second with ^{60}Co. The measured absorbed fractions were compared to calculated results obtained through the use of a Monte Carlo calculation. In general, these data were in agreement except for the data measured in positions representative of the gastrointestinal tract. From the results of this comparison it was concluded that, for radionuclides emitting very energetic photons, the distribution of the radionuclide within the source organ has little effect upon the absorbed fraction, if the source organ and target organ are not the same organ. Thus for many radionuclides a point source located at the center of the organ should be sufficient to use in many experiments designed to measure absorbed fractions. (auth)

22640 CRITICAL ANALYSIS OF THE SUBDIVISION OF RADIOISOTOPES INTO RADIOTOXICITY GROUPS. Failla, L. (CNEN, Rome). Energ. Nucl. (Milan); 22: No. 5, 274-277(May 1975).

An analysis is made in this article of the origin of the subdivision of radioisotopes into radiotoxicity groups and, though the importance of such subdivision is recognized as for the risk of internal contamination in the human body, it is shown that, as already found in the various international regulations, the same subdivision does not interest when such risk does not exist. However since it is not possible to totally exclude, at least theoretically, the internal contamination risk, it is necessary—in the author's opinion—to distinguish the situations caused by serious accidents from those corresponding to normal conditions of use; namely, the regulations of the uses of radioisotopes in normal conditions should not—as it happens in all the other technological fields—be so wide as to include accidental conditions, but should only be able to prevent them. (auth)

22641 SEALED SOURCES IN SYNTHETIC ABSORBABLE SUTURE: A NEW METHOD FOR PERMANENT INTERSTITIAL IMPLANTATION. Harter, D. J.; Delcios, L.; Jahns, M. F. (Univ. of Texas, Houston). Radiology; 116: No. 3, 721-723(Sep 1975).

Inactive gold grains are embedded at 1-cm intervals along a synthetic, absorbable surgical suture, then subjected to neutron irradiation in a nuclear reactor, forming a new material for permanent interstitial implant therapy. Assembling and activating the sealed sources in an absorbable carrier, the physical properties of the irradiated suture, its behavior in tissue, and the methods and results of implantation in the dog are described. (auth)

22642 RESULTS OF TREATING MALIGNANT MELANOMA INTRALYMPHATICALLY WITH RADIOACTIVE ISOTOPES. Ariel, I. M. (New York Medical Coll.). Surg. Gynecol. Obstet.; 139: No. 5, 726-730(Nov 1974).

Endolymphatically administered ^{131}I-Ethiodol delivers sufficient irradiation to the lymph nodes in human beings to destroy microscopic deposits of melanomatous cells lodged within the nodes. The primary melanoma is treated by orthodox surgical techniques. Patients classified as having clinical Stage I melanoma receive no additional surgical intervention but receive ^{131}I or ^{32}P endolymphatically and are, thus, spared the trauma of a radical axillary or groin dissection and their ensuing complications. A five year survival rate without evidence of residual or recurrent melanoma by 18 of the 22 patients observed five years or longer is encouraging. Patients with Stage II melanoma are treated endolymphatically by a combination of isotopes and surgical removal of the primary melanoma and the lymph nodes. The penetration of the irradiation from the administered isotope is not sufficient to destroy the cancer. In such instances, irradiation of lymph nodes outside the operative field, irradiation of any nodes inadvertently left behind, and irradiation to cancer cells within the lymphatic vessels offer an additional dimension in the treatment of these patients. A five year survival rate of 28.5 percent in a small group of patients is better than that obtained with surgical excision alone. (auth)

Animals

Refer also to abstract 22574.

22643 (COO-2506-1) BIOLOGICAL EFFECTS OF IMPLANTED NUCLEAR ENERGY SOURCES FOR ARTIFICIAL HEART DEVICES. Progress Report, September 1, 1974–August 31, 1975. Kalifelz, F. A.; Wentworth, R. A.; Cady, K. B. (New York State Veterinary Coll., Ithaca (USA). Dept. of Physical Biology). 1975. Contract E(11-1)-2506. 84p. Dep. NTIS $7.25.

Results are reported from a study of the biological effects of radiation from mock plutonium power sources in dogs and a study of the feasibility of a tissue heat sink for waste heat from such sources in calves. It is also designed to evaluate effects of heat and radiation from plutonium sources in calves. The work is part of a program to evaluate the use of plutonium as a power source for an artificial heart device. A total of 60 dogs have been implanted with mock plutonium sources (producing a similar radiation flux as plutonium but having no associated heat) at levels of from 1 to 70 times the expected radiation flux from a 30 watt plutonium source. Results up to 4.5 years after implantation indicate that mammals may be able to tolerate the radiation flux from such sources. Results in calves indicate that 30 watts of additional endogenous heat can be dissipated to a connective tissue covered heat exchanger with a surface area of 494 cm^2 providing a heat flux of 0.06 watts/cm^2. (auth)

22644 (ERDA-tr-31, pp 94-99) LONG-TERM RESULTS OF THE INJURY OF RATS AFTER INTRAPERITONEAL INJECTION OF AMERICIUM-241. Filippova, L. G.; Nifatov, A. N.; Buldakov, L. A. 1974. Translated from Radiobiologiya; 14; No. 6, 875-878(1974).

In Radiobiology.

Americium nitrate, when administered in a single intraperitoneal injection at doses of 2.66 and 13.33 mu Ci/kg, shortens the lifetime of animals by 20 to 50 percent and increases the frequency of appearance of osteosarcomas, kidney tumors, and leukemia. A comparison of the osteosarcomagenic effectiveness of americium nitrate with a citrate complex of the isotope and with various compounds of plutonium-239 is cited. (tr-auth)

22645 (LA-UR-75-1324) LUNG RESPONSE TO LOCALIZED IRRADIATION FROM PLUTONIUM MICROSPHERES. Anderson, E. C.; Holland, L. M.; Prine, J. R.; Thomas, R. G. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 6p. (CONF-750917-1). Dep. NTIS $4.00.

From 4th international symposium on inhaled particles and vapours; Edinburgh, Scotland, UK (22 Sep 1975).

Uniform spherical 10-mu m diameter particles of ZrO_2 ceramic, containing various concentrations of PuO_2, have been injected into the jugular vein of Syrian hamsters with subsequent permanent lodgment in the lung capillaries. The number of particles injected has varied from 2000 to 2,000,000, and the specific activity has been from 0.1 to 100 pCi/sphere so that lung burdens range from 0.2 to 1000 nCi. To date, approximately 3000 hamsters have been committed to the experiment and two-thirds have died--the expected rate for normal animals. Little biological damage has been observed, and only five primary lung tumors have been found that may be due to radiation delivered to the lung. To provide a comparison to more uniform radiation, soluble polonium has also been instilled intratracheally. Results from the microspheres suggest that localized lung irradiation alone is not sufficient cause for tumor induction and is much less hazardous than diffuse exposure. (auth)

22646 NEOPLASTIC AND LIFE-SPAN EFFECTS OF CHRONIC EXPOSURE TO TRITIUM. I. Effects on Adult Rats Exposed During Pregnancy. Cahill, D. F. (National Environmental Research Center, Triangle Park, NC); Wright, J. F.; Godbold, J. H.; Ward, J. M.; Laskey, J. W.; Tompkins, E. A. J. Natl. Cancer Inst.; 55: No. 2, 371-374(Aug 1975).

Female Sprague-Dawley rats were continuously exposed to equilibrium levels of tritiated water (HTO) during pregnancy. The tritium activities were 1, 10, 50, and 100 mu Ci HTO/ml body water which provided cumulative, whole-body radiation doses of approximately 6.6, 66, 330, and 660 rads. Administration of the radioisotope was terminated at parturition. Throughout their lifespans and at autopsy, the dams showed an increased incidence of mammary fibroadenomas at exposure to 330 and 660 rads. Although the data for the incidence of malignant mammary neoplasms were consistent with a linear dose response, the small numbers of tumors preclude specific definition of the dose-response curve. Postexposure life-spans for dams chronically exposed to 66, 330, and 660 rads during pregnancy were reduced by 14, 24, and 22 percent, respectively. Accelerated aging was also demonstrated in these rats: The mean age for mammary fibroadenoma onset decreased with an increasing dose of radiation. (auth)

22647 EFFECT OF GAMMA RADIATION ON THE PROTEIN METABOLISM. Galarza, A.; Carriazo, D.; Feijoo, B. (Facultad de Farmacia, Madrid). Rev. Esp. Fisiol.; 27: No. 4, 283-287 (Dec 1971). (In Spanish).

The effects of γ radiation on the blood proteins: albumins; globulins; fibrinogen; hemoglobin; urea and free aminoacids from various organs related with the blood composition (liver, spleen, kidney, lung, heart) were determined. Changes were observed in the blood protein concentrations; but do not think the drops were produced directly by the radiation: albumins, fibrinogen, and hemoglobin, decreased after the inoculation of 500 μCi/kg of $ZnCl_2$ while the globulins increased; the least hemoglobin concentration appeared immediately after the inoculation, with a maximum of ^{65}Zn in the organs; but the fibrinogen and the albumins decreased slowly, with a minimum at 25 days. In this period, the ^{65}Zn concentration in the organs is very small. The free proteinogenic aminoacids were not altered by the radiation. Delta aminolevulinic was the only aminoacid that increased. It is a hemoglobin precursor, and there is possibly a Hb decrease-δ-ALA increase relationship. An increment of urea in blood was observed, but this increment coincided with a deficient elimination by urine. Because of this, we do not think the urea elevation is produced by a major catabolism of proteins. (auth)

22648 LIVER PATHOCHEMISTRY AFTER ^{239}Pu ADMINISTRATION. Yolkina, N. I.; Tokarskaya, Z. B. (Inst. of Biophysics, Moscow). Vop. Med. Khim.; 9: No. 2, 154-160(1963). (In Russian).

Rabbit blood plasma protein fraction composition and urea biosynthesis in liver were investigated after plutonium-239 administration (7 Cu/kg). In dogs after plutonium-239 administration (2 Cu/kg.), biosynthesis of urea in liver, blood plasma protein fractions, glutaminate-aspartate, glutamate-alanine transaminase, and alkaline phosphatase activity were studied. In rabbit and dog blood plasma after Plutonium-239 administration a gradual decrease in total protein content mainly due to decrease in albumines was found. In dog blood plasma a gradual increase in transaminase activity was observed; the increase in glutamate-alanine transaminase activity was more distinct as compared with that of glutamate-aspartate transaminase activity. In dogs a reduction in urea biosynthesis was noted during the developing of pronounced liver cirrhosis. Blood plasma alkaline phosphatase activity was increased only in cases of distinct liver cirrhosis and jaundice. Albumin content decrease and transaminase activity increase were observed earlier than any morphological manifestation of intoxication could be noted. (auth)

Nuclide Kinetics and Toxicology

Man

22649 (SC-RR-69-183) EFFECT OF PARTICLE SIZE ON ORGAN DISTRIBUTION OF RADIOACTIVE MATERIAL DEPOSITED IN THE LUNGS. Parsont, M. A.; Holley, W. L.; Burnett, W. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1969. 23p. Dep. NTIS $4.25.

The effect of particle size on both the solubility and clearance of radioactive material in the lung and on the radiation dose to the lung and selected organs is discussed. A comparison is made between the doses and lung clearance as computed using: (1) the deposition and retention models of the Task Group on Lung Dynamics of the ICRP Panel, and (2) a model which includes consideration of solubility as a function of particle size. (auth)

22650 PLUTONIUM IN PERSPECTIVE. Wallis, L. R. (General Electric Co., San Jose, CA). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

Questions on the hazards of Pu are listed together with answers and refutations. They relate to toxicity, carcinogenicity, release and dispersal, state of knowledge of Pu effects in man, and contamination. (DLC)

22651 TESTS OF THE UPTAKE OF THYROID. New Method for the Uptake of ^{99m}Tc-pertechnetate. Ell, P. J. (Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares). J. Soc. Cienc. Med. Lisboa.; 138: No. 4-5, 191-285(Apr 1974). (In Portuguese).

A critical revision of physiological mechanisms, which are in the origin of the tests of thyroid function, is done. The tests of thyroid function and comparative evaluations with recent thyroid radionuclide uptake measurements versus further measurements are discussed. The advantages of the early study of the activity of thyroidal trap and the extrathyroidal radioactivity are studied. An original method of evaluation and determination of thyroid uptake is described. Comparative evaluations in 200 patients with iodine-131 after 4 and 24 hours versus ^{99m}Tc-pertechnetate after 15 and 30 minutes are made. A good correlation between these variables was found. The average value of ^{99m}Tc uptake in euthyroid patients after 15 and 30 minutes is 1.26 and 1.34% respectively. The utilization of ^{99m}Tc for thyroid function tests is recommended and the practical application of this original method is proved. (INIS)

22652 INVESTIGATION BY MEANS OF A PORTABLE RADIATION COUNTER OF THE CONTENT OF RADIOACTIVE SUBSTANCES IN THE BODY OF WORKERS. Voronin, K. V.; Golikov, V. Ya.; Korenkov, I. P.; Sokolv, A. D.; Suchkova, L. A.; Slutskina, S. I.; Chistyakov, M. I. Gig. Sanit.; No. 2, 50-53 (Feb 1975). (In Russian).

On the basis of the results of investigations performed in 1972 and 1973 to assess the content of radioactive substances in the body of personnel, working with ionizing radiation in various enterprises of Moscow, the authors conclude that the portable radiation counter is convenient for use and may be employed for everyday use in sanitary epidemiologic stations. (auth)

Animals

Refer also to abstracts 22479, 22601, 22678, 22705, and 22707.

22653 DIFFUSION RATE OF ^{131}I-LABELED HUMAN ALBUMIN IN THE EAR OF THE RABBIT. Fierro-Gossman, H.; Benitez-

Bribiesca, L. Res. Commun. Chem. Pathol. Pharmacol.; 8: No. 4, 719-722(Aug 1974).

The diffusion rate to the regional lymph nodes of isotopically labeled human albumin after subcutaneous injection in the ear of the rabbit was studied. It was found that in less than 2 minutes this macromolecule had reached the regional lymph nodes from a distance of 10 cm. There was a progressive increase of radioactivity during the following 19 minutes indicating a continuous and gradual arrival of protein. (auth)

22654 DAILY FLUCTUATIONS IN PLASMA CALCIUM, PHOSPHATE, AND THEIR RADIONUCLIDE CONCENTRATIONS IN THE RAT. Talmage, R. V.; Roycroft, J. H.; Anderson, J. J. B. (Univ. of North Carolina, Chapel Hill). AT(40-1)-4106. 17: No. 2, 91-102(1975).

Daily fluctuations in plasma calcium, phosphate, and their radionuclides (injected 5 or more days previously) were determined in rats maintained on a closely controlled feeding and light schedule. Male rats (150 to 300 g) were trained to a 7 a.m. to 7 p.m. light schedule with food available 9 p.m. to 9 a.m. All parameters dropped rapidly at the start of each feeding period and then rose during the day. The daily changes in radionuclide concentrations were several orders of magnitude greater than for the stable ions. Continuous access to food produced an earlier fall (5 p.m.) in all plasma values. In thyroidectomized rats (with parathyroid transplants) plasma calcium and phosphate remained relatively constant during the 24 h period. If the time of availability of food was moved 6 h earlier (no change in light cycle), the drop in these plasma values also occurred 6 h earlier. Closer examination of these daily changes indicated that all values fell at least 1 h prior to feeding. In fasted rats, plasma calcium and phosphate concentrations fell as usual; however, ^{45}Ca and ^{32}P rose instead of falling. It was concluded that, in normal rats, changes in endogenous calcitonin secretion may actually increase rather than decrease daily perturbations of plasma calcium and phosphate. Daily changes in these values are influenced by a conditioned reflex developed due to the feeding habits of the rats. Finally, it is suggested that intestinal hormones rather than calcium may be the primary control of calcitonin secretion, and that the gastrointestinal tract plays a major role, in addition to absorptive activity, in both calcium and phosphate homeostasis. (auth)

22655 HIGHLY IODINATED FIBRINOGEN: A NEW THROMBUS-LOCALIZING AGENT. Harwig, J. F.; Coleman, R. E.; Harwig, S. S. L.; Sherman, L. A.; Siegel, B. A.; Welch, M. J. (Washington Univ., St. Louis). J. Nucl. Med.; 16: No. 8, 756-763 (Aug 1975).

We have examined radioiodinated fibrinogen prepared at high levels of iodination as an agent for improved in vivo thrombus detection. Fibrinogen containing 25, 50, and 100 atoms of iodine per molecule is prepared by an electrolytic procedure and is compared with conventional radiolabeled fibrinogen (less than 0.5 iodine atom per molecule) prepared by the iodine monochloride method. The level of iodination has little effect on the isotopic clottability of the product, but its degree of aggregation and its rate of blood clearance in experimental animals is strongly dependent on iodination level. Isotopic thrombus : blood ratios obtained in recently induced thrombi with the 25 atom per molecule preparation average about 50 : 1, twice as high as the ratios obtained with conventionally labeled fibrinogen. (auth)

22656 KINETICS OF ^{111}In-BLEOMYCIN AND ^{111}In-CHLORIDES IN MICE. Konikowski, T.; Haynie, T. P.; Glenn, H. J. (Univ. of Texas, Houston). J. Nucl. Med.; 16: No. 8, 738-743(Aug 1975).

Indium-111 as the chloride and chelated to bleomycin has been reported useful as a tumor-scanning agent. This is a report of the kinetics of these compounds compared in Yale-Swiss mice bearing a transplantable, in situ brain sarcoma. Indium-111-chloride, pH 1.5, gave a maximum tumor uptake of 18.5 percent dose per gram tumor, a maximum tumor-to-brain ratio of 17.0, and a maximum tumor-to-blood ratio of 4.4. Its renal blood clearance was a slow 0.0022 ml/min. Indium-111-bleomycin showed a maximum tumor uptake of 3.0 percent dose per gram tumor, a maximum tumor-to-brain ratio of 13.5, a maximum tumor-to-blood ratio of 6.8, and renal blood clearance of 0.254 ml/min. The labeling of bleomycin with ^{111}In results in a tracer with localizing properties in this tumor model which are quite different from those obtained with ^{111}In-chloride. Both ^{111}In as chloride or that labeled to bleomycin would appear to have significant potential as agents for imaging tumors. (auth)

22657 EFFECT OF FASTING AND PARATHYROID HORMONE INJECTION ON PLASMA ^{45}Ca CONCENTRATIONS IN RATS. Talmage, R. V. (Univ. of North Carolina, Chapel Hill). Calcif. Tissue Res.; 17: No. 2, 1-10(1975).

Young male rats were administered ^{45}Ca 5 days to 2 weeks prior to use. All rats were either parathyroidectomized (PTX) or thyroparathyroidectomized (TPTX) and given several days to recover from surgery. The first group of rats were maintained on a 12 h dark-fed and 12 h light-fasted daily cycle. The remainder of the rats were used for parathyroid hormone (PTH) studies (0.1 to 0.6 U/g body weight) following which blood samples were obtained from the tail for 1 to 6 h. Two groups of these rats were bilaterally nephrectomized 18 h before PTH injection. Two contrasting results were obtained: in PTX (or TPTX) rats maintained on the closely regulated food and light regime, plasma ^{45}Ca concentrations rose markedly each day at the start of the fasting period and then fell slowly. Total plasma calcium values fell throughout the fasting period. A similar rise and fall was also observed in ^{45}Ca values of rats experimentally fasted after being maintained with food continuously available. In contrast, in all PTX or TPTX rats, PTH injection was followed by an equal rise in both plasma calcium and ^{45}Ca values so that for the first few hours plasma ^{45}Ca specific activity was unchanged. These data are consistent with the concept of a bone fluid compartment (BFC) separated by a cellular interface from the primary extracellular fluid space (ECF). It is postulated that through this cellular interface calcium is actively 'pumped' from the BFC to the ECF. The rise in plasma ^{45}Ca values at the start of fasting is explained on the basis of decreased entry of stable calcium from the gastrointestinal tract and a continued movement of calcium and ^{45}Ca during the first few hours after PTH injection is explained by a rapid action of PTH to increase the rate of calcium movement from BFC to ECF by its action at the cellular interface, without altering ^{45}Ca specific activity until such time as dissolution of bone crystals is required as a supply of calcium. (auth)

22658 TOXICOLOGY OF PLUTONIUM. Bair, W. J. (Battelle Pacific Northwest Labs., Richland, WA). Adv. Radiat. Biol.; 4: 255-315(1974).

Data are reviewed from studies on the toxicity of Pu in experimental animals. Of the several plutonium isotopes, only ^{238}Pu and ^{239}Pu have been studied well. Sufficient results have been obtained to show that the behavior of ^{238}Pu in biological systems and the resulting biological effects cannot be precisely predicted from studies of ^{239}Pu. This probably applies also to other radiologically important plutonium isotopes which have half-lives ranging from 45 days to 10^7 years and decay by beta-emission, electron capture, and spontaneous fission, as well as by emission of alpha-particles. All the biological effects of plutonium described in this review are attributed to alpha-particle radiation emitted by the plutonium. However, since plutonium is a chemically active heavy metal, one cannot ignore the possibility of chemical toxicity of the low-specific-activity isotopes, ^{239}Pu, ^{242}Pu, and ^{244}Pu. The preponderance of our knowledge of plutonium toxicology has come from short-term studies of relatively high dosage levels in several animal species. The consequences of high-level internal exposures can be predicted with confidence in experimental animals and probably also in man. However, considering the care with which plutonium is handled in the nuclear industry, a high-level contamination event is unlikely. Considerably less is known about the long-term effects of low levels of contamination. (250 references.) (CH)

22659 RETENTION IN THE LUNGS OF AEROSOL PARTICLES OF NATURAL RADIOACTIVE SUBSTANCES. Kapitanov, Yu. T.; Lyarskii, P. P.; Maltseva, M. M. (Scientific-Research Inst. for Hygiene Proceedings and Occupational Illnesses, Moscow). Gig. Sanit.; No. 2, 46-50(Feb 1975). (In Russian).

An experiment performed on albino rats proved the coefficient of retention in the lungs of aerosol particles of a mixture of various substances or that of similar ones to be inversely proportional to the mass median aerodynamic diameters. When determined by various elements the coefficients of retention of particles of similar complex compounds differed considerably from each other. (auth)

22660 BIOLOGICAL ACTION OF URANIUM OXIDE-PROTOXIDE IN CHRONIC INHALATION POISONING. Galibin, G. P. (Scientific-Research Inst. for Occupational and Professional Hygiene, Moscow). Gig. Sanit.; No. 2, 41-46(Feb 1975). (In Russian).

An experiment carried out with albino rats showed that in chronic daily 4-hour inhalation of uranium oxide-protoxide a concentration of 10 mg/m^3 is toxic for rats and that of 1 mg/m^3 is close to minimal effective dose under similar test conditions. The concentration of 10 mg/m^3 produces in rats disturbances in the functioning of the kidneys and liver (at the height of intoxication), a fall of haemoglobin content, eosinophilia, and an increase in the number of blood cells with altered fluorescence. In a chronic inhalation of uranium oxide-protoxide at a concentration of 1 mg/m^3 the absorbed tissue doses according to α-radiation of uranium in the lungs amounted to about 30 rem/yr, and in other organs (bones, kidneys, spleen, liver) it was by 1 to 2 log lower. (auth)

22661 FLUX OF CADMIUM THROUGH EUPHAUSIIDS. Benayoun, G.; Fowler, S. W.; Oregioni, B. (International Lab. of Marine Radioactivity, Monte Carlo). Radioact. Sea; No. 47, 1-25 (1975).

Flux of the heavy metal cadmium through the euphausiid Meganyctiphanes norvegica was examined. Radiotracer experiments showed that cadmium can be accumulated either directly from water or through the food chain. When comparing equilibrium cadmium concentration factors based on stable element measurements with those obtained from radiotracer experiments, it is evident that exchange between cadmium in the water and that in euphausiid tissue is a relatively slow process, indicating that, in the long term, ingestion of cadmium will probably be the more important route for the accumulation of this metal. Approximately 10% of cadmium ingested by euphausiids was incorporated into internal tissues when the food source was radioactive Artemia. After 1 month cadmium, accumulated directly from water, was found to be most concentrated in the viscera with lesser amounts in eyes, exoskeleton and muscle, respectively. Use of a simple model, based on the assumption that cadmium taken in by the organism must equal cadmium released plus that accumulated in tissue, allowed assessment of the relative importance of various metabolic parameters in controlling the cadmium flux through euphausiids. Fecal pellets, due to their relatively high rate of production and high cadmium content, accounted for 84% of the total cadmium flux through M. norvegica. Comparisons of stable cadmium concentrations in natural euphausiid food and the organism's resultant fecal pellets indicate that the cadmium concentration in ingested material was increased nearly 5-fold during its passage through the euphausiid. From comparisons of all routes by which cadmium can be released from M. norvegica to the water column, it is concluded that fecal pellet deposition represents the principal mechanism effecting the downward vertical transport of cadmium by this species. (auth)

22662 TRANSFER OF ^{65}Zn FROM SEDIMENTS BY MARINE POLYCHAETE WORMS. Renfro, W. C. (International Lab. of Marine Radioactivity, Monte Carlo). Radioact. Sea; No. 46, 1-35(1975).

Silty marine sediments spiked with ^{65}Zn lose only small fractions of their radioactivity when exposed to slowly flowing seawater for several weeks. However, polychaete worms (Nereis diversicolor), burrowing through the sediment, cause ^{65}Zn losses 3 to 7 times higher than in sediment without worms. Long-term experiments on the uptake and loss of ^{65}Zn by the polychaete Hermion hystrix indicate that 60 or more days exposure are required for this worm to approach steady state with ^{65}Zn in the sediment. Biological half-life estimates for ^{65}Zn accumulated from sediment by H. hystrix are extremely variable (52 to 197 days), depending on the loss-time interval chosen for the calculation. Following 5 days exposure to 16 cm^3 of radioactive sediment, N. diversicolor individuals contained an average of 0.2% of the total ^{65}Zn in the sediment. When these worms were transferred to non-radioactive sediment, estimates of biological half-life for ^{65}Zn averaged 14 to 17 days during the loss period Day 3 to Day 15. Based on these experimental results, it is estimated that a population of N. diversicolor could cause an annual loss of 3% more of the ^{65}Zn in the upper 2 cm of the sediment of a hypothetical radioactive estuary. (auth)

22663 REMOVAL OF POLYMERIC PLUTONIUM BY DTPA DIRECTED INTO CELLS BY LIPOSOME ENCAPSULATION. Rosenthal, M. W.; Rahman, Y. E.; Moretti, E. S.; Cerny, E. A. (Argonne National Lab., IL). Radiat. Res.; 63: No. 2, 262-274 (Aug 1975).

DTPA (diethylenetriaminepentaacetic acid) encapsulated within lipid spherules' (liposomes) removes more plutonium (Pu) from the liver and femurs of mice injected with polymeric Pu than conventional nonencapsulated DTPA. A single intravenous injection, 3 days after Pu injection, of 100 mg/kg of the calcium trisodium salt of DTPA encapsulated in liposomes made with phosphatidylcholine and cholesterol (3:1) reduced the Pu in liver to 43 to 51 percent of the control level at 10 days, compared to 60 percent after injection of nonencapsulated DTPA. It reduced the Pu in the femurs to 60.4 to 62.5 percent of the control level, compared to 83 to 113 percent. Liposomal DTPA was equally effective when given intraperitoneally, or when stored for 3 days before use. Liposomal DTPA at doses as low as 25 mg/kg was not significantly less effective than a higher dose of 100 mg/kg. Four once-weekly injections of liposomal DTPA continued to give improved removal of Pu compared to conventional DTPA. When given 24 days after Pu, liposomal DTPA had a greater advantage over nonencapsulated DTPA in the liver than at 3 days, and removed 22 percent of the Pu from the femurs, compared to no removal by the nonencapsulated form. DTPA liposomes made with lipids other than phosphatidylcholine and cholesterol, or with different surface charges, thus far offer no advantage for Pu removal. (auth)

22664 REMOVAL OF POLYMERIC PLUTONIUM FROM DOGS WITH DTPA AND GLUCAN. Rosenthal, M. W.; Lindenbaum, A.; Baxter, D. W.; Kalesperis, G. S.; Moretti, E. S.; Russell, J. J. (Argonne National Lab., IL). Radiat. Res.; 63: No. 2, 253-261 (Aug 1975).

A highly polymeric preparation of plutonium-239 was injected intravenously into five groups of beagle dogs. An untreated control group was killed at 6 days after injection. The four treated groups, killed at 90 days, received one of the following by intravenous injection: (a) 15 mg/kg of glucan on days 6, 34, and 62; (b) 100 mg/kg of the calcium chelate of DTPA, twice weekly for 12 wk, beginning on day 6; (c) both of these treatments; or (d) saline. Between days 6 and 90, the amount of plutonium in the liver decreased from 92.2 to 85.6 percent of the injected dose (ID) after saline, to 81.6 percent after glucan, to 77.8 percent after DTPA, and to 71.0 percent after both glucan and DTPA. The decrease to 71.0 percent, an approximately additive effect, was statistically significant. In dogs treated with either saline or glucan, the plutonium levels of the bones and the soft tissues other than the liver were higher than those in animals treated with DTPA. The 90-day excretion of plutonium in feces was low in all groups (3.3 percent ID, or less), while urinary plutonium was 3.5 percent ID after saline, 4.0 percent after glucan, 13.4 percent after DTPA, and 21.1 percent after glucan plus DTPA. These results confirm in dogs, as previously determined in mice, the action of glucan as an adjunct to DTPA in removal of polymeric plutonium from the liver. (auth)

22665 TISSUE DISTRIBUTION OF ^{14}C-, ^{125}I, AND ^{131}I-DIPHENYLHYDANTOIN IN THE TOADFISH, RAT, AND HUMAN WITH INSULINOMAS. Balachandran, S.; Beierwaltes, W. H.; Ice, R. D. (Univ. of Michigan, Ann Arbor). J. Nucl. Med.; 16: No. 8, 775-779(Aug 1975).

Carbon-14-diphenylhydantoin (DPH) concentrated maximally in pancreatic islet cells of the toadfish 10 min after its intravenous administration. The islet cell-to-acinar-tissue ratio at this time was 6:1. The islet cell-to-liver ratio was 20:1. Iodine-125-paraiodo-DPH at 10 min in the toadfish showed an islet cell-to-acinar-tissue ratio of 1.7:1 and an islet cell-to-liver ratio of 2.3:1. When ^{14}C-DPH was given to four patients 10 to 17 min before removal of normal pancreatic tissue and of an insulinoma in three of the patients, the concentration of radioactivity in the insulinoma was never greater than in the pancreas and concentrations in insulinoma and pancreas were always less than in liver in the same individual. Forty-five to 90 min after administration of ^{131}I-DPH, the liver and pancreas were delineated in three patients but the insulinoma was not imaged. Five days after administration of ^{131}I-DPH, the concentration of ^{131}I radioactivity in excised tissue was greater in the insulinomas than in the pancreas of two patients and greater than in liver of one patient but not sufficient to produce positive images of the insulinoma in the pancreas. (auth)

22666 PATTERN OF ORGAN DISTRIBUTION AND ELIMINATION RATES OF ^{125}I-IODOPHYENYLALANINE AND ^{75}Se-SELENOMETHIONINE IN MICE AND DOGS. Meinhold, M.; Hollihn, U.; Schwartz-Porsche, D. (Free Univ., Berlin). J. Nucl. Biol. Med.; 19: No. 1, 12-21(1975).

The patterns of organ distribution, metabolic kinetics, and elimination rates of ^{125}I-iodophenylalanine and ^{75}Se-selenomethionine were investigated in mice and dogs. In both species, ^{75}Se-selenomethionine accumulated in pancreas and liver, was incorporated into protein and mainly excreted by the kidney. ^{125}I-iodophenylalanine uptake into the pancreas was high in mice, absent in dogs; in both species, it was not concentrated by the liver, was not incorporated into protein, and was eliminated at a higher rate than selenomethionine. The only route of excretion was the kidney. From the kinetic and species differences the conclusion is drawn that iodinated phenylalanine may not be a promising radiopharmaceutical for clinical use in human pancreas scanning. (auth)

22667 EFFECTS OF BUFFERS AND pH ON IN VITRO BINDING OF ^{67}Ga BY L1210 LEUKEMIC CELLS. Glickson, J. D.; Webb, J.; Gams, R. A. (Univ. of Alabama, Birmingham). Cancer Res.; 34: No. 11, 2957-2960(Nov 1974).

The effect of sodium nitrate and a series of buffers on in vitro ^{67}Ga binding to L1210 leukemic cells at pH 6.8 ± 0.2 and 37° at concentrations of 10^{-1} to 10^{-2} M has been investigated. The relative ability of these agents to inhibit cellular incorporation of ^{67}Ga is given. Inhibition probably results from formation of gallium(III) complexes which are either impermeable to the tumor membrane or which compete with intracellular receptor complexes. However, direct interaction of buffers with the cell membrane or with gallium(III) receptors, as well as effects of

buffers on cellular metabolism, have not been excluded. A monotonic decrease in the cellular incorporation of ^{67}Ga occurs between pH 6.2 and 7.8 in the presence of the inert buffer, 10^{-2} M morpholinopropane sulfonic acid. (auth)

Plants

Refer also to abstract 22285.

22668 (LBL-3217, pp 236-239) NITRATE MOVEMENT AND PLANT UPTAKE OF N IN A FIELD SOIL RECEIVING ^{15}N-ENRICHED FERTILIZER. Broadbent, F. E.; Krauter, C. (Univ. of California, Davis). 1974.

From second annual NSF-RANN trace contaminants conference; Pacific Grove, California, USA (29 Aug 1974).

In trace contaminants in the environment. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

A plot of 13.9 m^2 on Yolo fine sandy loam was fertilized with $(NH_4)_2SO_4$ containing 8.04 atom percent excess ^{15}N at the rate of 112 kg N/hectare and planted first to wheat and then to corn. The plot was surrounded by a buffer zone of 405 m^2 which was treated in identical fashion except that unlabeled fertilizer was used. Porous ceramic probes for measuring soil moisture tension and for extraction of soil solution were installed depths from 15 to 180 cm. Harvested crops were analyzed for ^{15}N as were soil cores taken after crop harvest. Nitrate-N concentrations in the soil solution at 15 cm ranged from a maximum in March of 70 ppM, of which 39 ppM was derived from fertilizer, to a minimum of 0.2 ppM in July. The largest amount of fertilizer-derived NO_3-N at 180 cm was 0.28 percent of that applied, contributing 0.36 ppM to the concentration at that depth. The wheat crop removed 32.3 percent of the fertilizer N and the corn crop utilized 22.8 percent. Organic and inorganic N remaining in the soil after cropping represented 32.9 percent of the applied N, leaving 12.0 percent unaccounted for. The consistently low nitrate concentrations at 180 cm suggest that this deficit was not due to leaching, and should be attributed to denitrification. (auth)

22669 (LBL-3217, pp 333-339) USE OF ^{210}Pb AND ^{109}Cd ISOTOPES IN A PRELIMINARY STUDY OF THEIR UPTAKE AND TRANSLOCATION BY PLANTS. Rule, J.; Hemphill, D.; Pierce, J. O. (Univ. of Missouri, Columbia). 1974.

From second annual NSF-RANN trace contaminants conference; Pacific Grove, California, USA (29 Aug 1974).

In trace contaminants in the environment. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Leaf lettuce and white icicle radish were grown under greenhouse culture for a period of three and one-half weeks. Appropriate solutions of Pb $(NO_3)_2$ or $CdCl_2$ were applied to foliage via a micropipette. These solutions also contained radioisotopes of Pb or Cd. The plants were grown for an additional three and one-half weeks, harvested and analyzed. Results of autoradiography and scintillation analyses of the radioisotopes showed foliar absorption and subsequent translocation of both metals. In the lettuce the greatest translocation was to the youngest leaves of the plant and in the radish to the storage root, in both cases the edible portion of these plants. Thus, it seems that foliar absorption of heavy metals may well be an important source of contamination of radish and leaf lettuce. (auth)

22670 HYDROGEN–TRITIUM EXCHANGE KINETICS OF SOYBEAN TRYPSIN INHIBITOR (KUNITZ). Solvent Accessibility in the Folded Conformation. Ellis, L. M.; Bloomfield, V. A.; Woodward, C. K. (Univ. of Minnesota, St. Paul). Biochemistry; 14: No. 15, 3413-3419(29 Jul 1975).

The hydrogen exchange kinetics of Kunitz soybean trypsin inhibitor (STI) has been studied at pH 2, 3, and 6.5. From the temperature dependence of proton exchange at low pH, the contribution of major, reversible protein unfolding to the hydrogen exchange kinetics has been determined. Exchange directly from the folded conformation is characterized by an apparent activation energy (E/sub app/*) of approximately 25 kcal/mol, close to that of the chemical exchange step. At pH 6.5 the protein is more temperature stable than at low pH, and exchange of all but approximately equal to 8 protons can be observed to exchange with E/sub app/* approximately equal to 27 kcal/mol. This implies that all but approximately equal to 8 protons are accessible to exchange with solvent in the solution structure of folded STI. Estimates can be made of the average number of water molecules per molecule of STI consistent with a solvent accessibility model of hydrogen exchange kinetics. These estimates indicate that very few water molecules within the protein matrix are necessary to explain the exchange data. Calculations are done for the STI hydrogen exchange kinetics at pH 3, 30^0, approximating STI structure by a sphere of radius equals 18 A. These calculations indicate an average of approximately equal to 4 water molecules in the shell from 13 to 16 A from the center of the molecule, while less than 1 water molecule is indicated in the innermost 13 A. These calculations also suggest that there are approximately equal to 190 water molecules associated with the outermost 1.5 to 2 A of the sphere. While these values are consistent with a hydrophobic region in the central protein matrix, they indicate more solvent accessibility in the outer ½ of the molecule than the static accessibility estimates made from x-ray coordinates. Our results suggest that any protein movements or fluctuations responsible for solvent accessibility in proton exchange processes are localized in the outer regions of the globular structure. (auth)

22671 HYDROGEN EXCHANGE KINETICS CHANGES UPON FORMATION OF THE SOYBEAN TRYPSIN INHIBITOR: TRYPSIN COMPLEX. Woodward, C. K.; Ellis, L. M. (Univ. of Minnesota, St. Paul). Biochemistry; 14: No. 15, 3419-3423(29 Jul 1975).

The hydrogen exchange kinetics of the complex of trypsin–soybean trypsin inhibitor (Kunitz) have been compared to the calculated sum of the exchange kinetics for the inhibitor and trypsin measured separately. The exchange rates observed for the complex are substantially less than the sum of the exchange rates in the two individual proteins. These results cannot be accounted for by changes in intermolecular or intramolecular hydrogen bonding. The decrease in exchange rates in the complex are ascribed to changes in solvent accessibility in the component proteins. (auth)

New Tracer Techniques

Refer also to abstracts 22029, 22030, 22034, 22325, 22457, 22509, 22516, 22651, 22653, 22655, 22665, and 22666.

22672 (BNL-20062) QUANTITATION OF THE DEGREE OF OSTEOPOROSIS BY MEASURE OF TOTAL-BODY CALCIUM EMPLOYING NEUTRON ACTIVATION. Cohn, S. H.; Zanzi, I.; Vaswani, A.; Wallach, S.; Aloia, J.; Ellis, K. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 8p. (CONF-750557-1). Dep. NTIS $4.00.

From 11th European symposium on calcified tissues; Elsinore, Denmark (25 May 1975).

Two techniques for measuring the amount of Ca in the total skeleton were employed: total-body neutron activation analysis (TBNAA) and the determination of the mineral content of a bone of the appendicular skeleton (absorptiometric measurement of the radius, BMC). (auth)

22673 RADIOLOGY AND PEDIATRICS: NEW RELATIONSHIPS. O'Connor, J. F. (Boston Univ.). Pediatr. Clin. North Am.; 21: No. 2, 323-340(May 1974).

The most recent advances in pediatric radiology have been in ultrasound, B scanning, computerized transverse axial tomography (C.A.T. scanning), and radioisotope matrix bone scanning. In addition to these subjects, newly evolving relationships between pediatricians and radiologists with emphasis on indications for routine radiologic procedures and the issue of informed consent will be discussed. (auth)

22674 GASTRIC MUCOSAL BLOOD FLOW MEASUREMENT. Sales, J.; Bickel, J.; Norton, L.; Eiseman, B. J. Surg. Res.; 17: No. 3, 171-176(Sep 1974).

Pertechnetate clearance (C/sub Tc/) by the stomach before and after betazole stimulation was compared to regional measurements of gastric blood flow utilizing nuclide (Chromium-51 and Cerium-141)-labeled microspheres in five piglets. Pertechnetate clearance closely correlated (correlation coefficient 0.926) with mucosal blood flow in the gastric corpus measured by the microsphere technique. Betazole increased blood flow in the corpus region by 100 percent but did not alter this relationship. Except in one experiment, microsphere blood flow valves in the antrum and fundus were unchanged by betazole and did not significantly correlate with pertechnetate clearance. Pertechnetate clearance appears to be a reliable method of determining gastric mucosal blood flow in experimental animals and may be considered as a noninvasive method for measuring such flow in humans. (auth)

22675 DETECTION OF ACUTE MYOCARDIAL INFARCTION BY /sup 99m/Tc POLYPHOSPHATE. McLaughlin, P.; Coates, G.; Wood, D.; Cradduck, T.; Morch, J. (Toronto General Hospital). Am. J. Cardiol.; 35: No. 3, 390-396(Mar 1975).

Experimental work has shown that technetium-99m (/sup 99m/Tc) pyrophosphate accumulates in recently infarcted myocardium and can be detected by external imaging techniques. Twenty-two /sup 99m/Tc polyphosphate myocardial studies were performed in 17 patients (in three after cardiac surgery) 3 to 20 days after myocardial infarction. Seventeen myocardial studies were performed in 17 control patients (in six after cardiac surgery). Twenty millicuries of /sup 99m/Tc polyphosphate was injected intravenously 60 to 120 minutes prior to gamma camera imaging in several views. Myocardial images were processed by the Gamma-11 computer system using standardized background

subtraction and contrast enhancement. Results of 16 myocardial studies performed 4 to 20 days after transmural myocardial infarction in 12 patients were positive in 13 instances and questionable in 1. The location of the myocardial infarction by imaging corresponded to location by standard electrocardiographic criteria in 8 of the 10 patients with positive findings. In five patients with nontransmural myocardial infarction, results of myocardial imaging were positive in two, questionable in one, and normal in one. In one patient with questionable findings results were normal when imaging was repeated 16 days after nontransmural myocardial infarction. Results of 17 control myocardial imaging studies were normal in 16 and questionable in 1. Therefore, /sup 99m/Tc polyphosphate myocardial imaging appears promising in the detection and location of transmural myocardial infarction. (auth)

22676 NONINVASIVE STUDY OF EXTREMITY PERFUSION BY ^{43}K SCANNING. Miyamoto, A. T.; Mishkin, F. S.; Maxwell, T. M. (Martin Luther King, Jr. General Hospital, Los Angeles). Arch. Surg. (Chicago).; 110: No. 1, 58-63(Jan 1975).

In nine patients with lower extremity symptoms of arterial insufficiency, potassium chloride ^{43}K was injected intravenously during rest, reactive hyperemia, or exercise. Decreased radioactivity in muscle tissue was observed to correspond with symptoms, physical findings, Doppler ultrasound pressures, and angiographic findings in all six who had the procedure. Studies following surgical endarterectomies in two, a bypass procedure in one, and exploration without attempted reconstruction in one showed good correlation with postoperative symptoms, physical findings, and pressure measurements using Doppler ultrasound in three of four patients. The fourth patient showed no change on the postoperative study despite clinical improvement. These findings suggest that intravenously administered radioactive potassium provides a noninvasive means for demonstrating the perfused muscle mass of the extremities with delineation of ischemic areas. The risk of arterial puncture is eliminated, and the ability to visualize perfusion patterns during exercise is unique to this method. (auth)

22677 DIAGNOSIS OF ESTABLISHED DEEP-VEIN THROMBOSIS IN THE LEG USING ^{131}I FIBRINOGEN. Partsch, H.; Lofferer, O.; Mostbeck, A. (Wilhelminenspital, Vienna). Angiology.; 25: No. 11, 719-728(Dec 1974).

The ^{131}I fibrinogen test is not only a useful and simple test for the early detection of occult forming thrombosis, but also a satisfactorily accurate method for confirming the clinical diagnosis of established deep vein thrombosis. This was shown by three groups of experiments in a total of 259 patients: A complete correlation with ascending phlebography was found in 39/47 patients (equals 83 percent). Using ^{131}I fibrinogen with its higher tissue penetration compared with ^{125}I-fibrinogen also thromboses in the deep thigh veins could be detected. In three cases with superficial thrombophlebitis taken as a model for deep vein thrombosis, excisions of thrombosed veins were made 24 hours after ^{131}I-fibrinogen injection. In vitro measurements of radioactivity revealed more fibrinogen/fibrin in the vein wall and in the surrounding fatty tissue than in the thrombus itself. This shows that the substrate for a positive fibrinogen test in established thrombosis is not only due to the active intravascular clotting but also to an accumulation of fibrinogen in the vein wall and the surrounding fatty tissue. Twenty-two patients undergoing sclerotherapy of their varicose veins were taken as a model for artificial thrombosis with a distinct time of onset. It was shown that the fibrinogen kinetics in forming and established thrombosis were different thus confirming different substrates for a positive test in such cases. (auth)

22678 MYOCARDIAL AND TOTAL BODY EXTRACTIONS OF RADIORUBIDIUM IN ANESTHETIZED DOGS. Downey, H. F.; Bashour, F. A.; Parker, P. E.; Bashour, C. A.; Rutherford, C. S. (Univ. of Texas, Dallas). J. Appl. Physiol.; 38: No. 1, 31-32(Jan 1975).

Myocardium (E/sub M) and average total body (E/sub TB/) extractions of ^{86}Rb were determined in 24 anesthetized, open-chest dogs. Blood from the coronary sinus and from the pulmonary artery reflected the uptake of ^{86}Rb by myocardium and the total body, respectively, and extractions were computed from the relative arteriovenous differences (A-V/A). While the arterial concentration of ^{86}Rb was constant, E/sub M/ varied from 0.66 +- .02 (SE) at 2 to 2.5 min to 0.65 +- 0.02 at 5 to 5.5 min, and E/sub TB/ varied from 0.63 +- 0.01 to 0.58 +- 0.01 over the same interval. Mean extractions were similar statistically at 2 to 2.5 min, but individual differences as great as 30 percent were encountered at the 95 percent confidence level. After 3 min of ^{86}Rb administration, E/sub M/ significantly exceeded E/sub TB/ (P less than 0.05) due to the more rapid decline with time of E/sub TB/. The similarity of the early extractions of ^{86}Rb by myocardium and by the total body supports, in general, the use of the radiorubidium uptake method for measuring coronary blood flow. However, the administration of the indicator should be brief, and rather large errors in individual estimates must be anticipated. (auth)

22679 MYOCARDIAL IMAGING WITH /sup 113m/In- AND /sup 99m/Tc-MACROAGGREGATED ALBUMIN: NEW PROCEDURE FOR IDENTIFICATION OF STRESS-INDUCED REGIONAL ISCHEMIA. Ritchie, J. L.; Hamilton, G. W.; Gould, K. L.; Allen, D.; Kennedy, G. W.; Hammermeister, K. E. (Veterans Administration Hospital, Seattle). Am. J. Cardiol.; 35: No. 3, 380-389(Mar 1975).

Regional coronary blood flow distribution was studied by myocardial imaging after intracoronary injection of technetium-99m- and indium-113m-macroaggregated albumin at rest and during coronary hyperemia induced by intracoronary injection of Hypaque-M, 75 percent. The four- to five-fold increase in coronary flow after injection of radiographic contrast material was similar in magnitude to that occurring with maximal exercise stress. Experimentally, resting coronary blood flow and regional distribution of radioactive particles remains normal in spite of coronary stenosis of up to 85 percent. Less severe stenosis causes flow and distribution abnormalities only during periods of increased flow, and the degree of maldistribution is directly related to the physiologic severity of the stenosis. Of 49 patients with suspected coronary artery disease, 10 had no significant lesions by coronary arteriography and all had normal images at rest and during coronary hyperemia. Thirty-seven of 39 patients with significant obstructive coronary artery disease had abnormal images at rest or during contrast agent-induced hyperemia, or both. Patients with significant coronary artery disease without previous infarction usually demonstrated abnormalities in flow distribution only during coronary hyperemia. Patients with previous infarction demonstrated resting perfusion abnormalities that often became more abnormal during hyperemia. This technique provides a new method for assessing the physiologic effects of coronary stenosis in conjunction with coronary arteriography. (auth)

22680 BRAIN SCAN. Holman, B. L. (Harvard Medical School, Boston). Postgrad. Med.; 54: No. 4, 143-149(1974).

Brain scanning is used to determine the presence, location, and course of neurologic disease. Tumors, cerebral infarcts, abscesses, and trauma present as areas of increased isotope uptake on the scan. In reaching a diagnosis, results of physical examination and laboratory studies should be evaluated in conjunction with the scintigraphic findings. While the scan helps detect focal neurologic disease, accurate differential diagnosis usually requires further neuroradiologic studies. (auth)

22681 STUDIES WITH RADIOACTIVE IODINE LABELLED ESTROGENS AS PROSTATE SCANNING AGENTS. Ghanadian, R. (Royal Postgraduate Medical School, London); Chisholm, G. D.; Waters, S. L.; Thakur, M. L. Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 343-346(Jun 1975).

A method for the preparation of high specific activity iodo-oestrogens is described together with the results of distribution studies of ^{131}I iodo-oestradiol in the rat. It was concluded that the uptake of the radioactivity by the prostate was insufficient for localization studies by external detectors, and that in vivo, 2, iodo and 2, 4 di-iodo-oestradiol released iodine, as suggested by the deposition of radioactivity into the thyroid. (auth)

22682 ISOTOPE CISTERNOGRAPHY AND VENTRICULOGRAPHY IN THE DIAGNOSIS OF HYDROCEPHALUS. Hammock, M. K. (National Institutes of Health, Bethesda, MD); Milhorat, T. H.; Davis, D. A. Dev. Med. Child. Neurol.; 16: No. 6, 58-71 (Dec 1974).

Although isotope cisternography and ventriculography are by no means substitutes for air encephalography, they may provide useful additional information about cerebrospinal fluid flow and dynamics. Following the subarachnoid or intraventricular injection of a radiopharmaceutical, the tracer flows with the CSF and demonstrates the pathways of circulation in a relatively dynamic way. The eventual distribution of the tracer is complex and is dictated in each case by the pathological and pathophysiological features of the given illness. The following findings have been demonstrated in non-communicating hydrocephalus: a ventricular double-density pattern representing the transependymal migration of intraventricularly injected radiopharmaceuticals; isotopic penetration of ventricular obstructions presumed to be complete obstructions on the basis of air or positive contrast ventriculography; and a secondary obstruction of the subarachnoid pathways as demonstrated by isotope cisternography. In patients with communicating hydrocephalus, intrathecally injected radiopharmaceuticals characteristically reflux into the cerebral ventricles; and here, too, the ventricular double-density pattern can be seen. Preliminary findings of isotope ventriculography in nine patients

with myelomeningocele suggest that the spinal subarachnoid pathways may assume as yet undetermined significance in certain CSF obstructions and that there may be a preferential route of descent of CSF from the ventricles to the spinal canal in the apparently unobstructed system. (auth)

22683 RADIOISOTOPIC ASSESSMENT OF PHYTOHAEMAGGLUTININ–STIMULATED LYMPHOCYTES FROM PATIENTS WITH PROTEIN CALORIE MALNUTRITION. Burgess, B. J. (Natal Inst. of Immunology, Durban, South Africa); Vos, G. H.; Coovadia, H. M.; Smythe, P. M.; Parent, M. A.; Loening, W. E. L. S. Afr. Med. J.; 48: No. 44, 1870-1872(11 Sep 1974).

Depressed uptakes of ^{3}H-thymidine after phytohaemagglutinin (PHA) stimulation of lymphocytes were found in 37.5% of 24 patients with protein calorie malnutrition (PCM). Folate deficiency accounted for 50% of these depressed uptakes. Iron deficiency was not a significant factor. ^{3}H-uridine uptake (RNA) was reduced in 37.5% of patients, and in the majority of cases when uridine uptake was depressed the same was found for thymidine. An unexpected finding was the lack of correlation between the morphological (100% abnormal) and the radio-isotopic assessment (37.5% abnormal) in PHA-induced lymphocyte transformation. (auth)

22684 ORGAN DISTRIBUTION OF RADIOACTIVITY AND DISAPPEARANCE OF RADIOACTIVITY FROM PLASMA AFTER ADMINISTRATION OF [^{3}H] LUTEINIZING HORMONE-RELEASING HORMONE TO MICE AND RATS. DuPont, A.; Labrie, F.; Pelletier, G.; Puviani, R.; Coy, D. H.; Coy, E. J.; Schally, A. V. (Laval Univ., Quebec). Neuroendocrinology; 16: No. 2, 65-73 (1974).

Whole-body autoradiography of a mouse 5 min after an intrajugular injection of 43 nmoles of 1-(4-[^{3}H]pyro-Glu)-LH-RH (18.3 Ci/nmole) shows a large accumulation of radioactivity in the pituitary, subcutaneous tissue, intestinal wall, kidney, and bladder. Some radioactivity is also found in the liver, lungs, and heart, but no labeling is seen in the central nervous system. Direct measurements of radioactivity in different organs of the rat 5 min after injection of [^{3}H] LH-RH also show that the highest accumulation of radioactivity is in the anterior pituitary gland, kidney, epididymal fat, and skin. Low labeling is measured in the posterior (including intermediate) lobe of the pituitary, pineal, liver, submaxillary gland, testis, adrenal, thyroid, and striated muscle. The pattern of plasma radioactivity after a single intravenous injection of [^{3}H] LH-RH can be represented by the sum of four exponents, suggesting a four-compartment model of the disappearance of radioactivity from plasma. The metabolic clearance rate is 1.2 ml/min. The half-life of the first exponent (up to 10 min after injection) is about 7.5 min. 30 sec after injection of [^{3}H] LH-RH, the radioactivity is distributed in a total volume of 26.5 ml (approximately 11% of body weight). (auth)

22685 DIRECT MEASUREMENT OF THYROXINE IN SERUM BY RADIOIMMUNOASSAY. Sawhney, R. C.; Rastogi, G. K. (Post-graduate Inst. of Medical Education and Research, Chandigarh, India). Indian J. Med. Res.; 62: No. 8, 1233-1240(Aug 1974).

A direct, sensitive, reproducible, and rapid radioimmunoassay of thyroxine (T_4) in the serum has been described. The specific T_4 antiserum was raised in rabbits by injecting T_4 bovine serum albumin conjugate with complete Freunds adjuvant. Antisera suitable for radioimmunoassay were obtained from all the five rabbits immunized, after 4 to 6 injections at fortnightly intervals. To dissociate thyroxine from thyroxine binding globulin, 8-anilmo-1-nephthalene sulfonic acid (ANS) 150 μg./25 μl. serum was used. Sera from euthyroid subjects could be assayed in 10 μl. quantity as the sensitivity of the assay was 2.5 ng./ml. The serum T_4 level in healthy euthyroid subjects ranged from 6.8 to 10 μg/100 ml. with a mean of 8.23 ± 0.12 (SEM). There was no overlapping between the values of established hypo, hyper, and euthyroid subjects. (auth)

22686 CEREBRAL SCINTIGRAPHY IN THE DIAGNOSTICS OF INTRACRANIAL LESIONS IN CHILDREN. Strozova, A.; Pokorna, I.; Bardosova, G.; Magdo, J. Cesk. Radiol.; 28: No. 5, 343-352(1974). (In Czech).

The review reports the summary of results with cerebral scintigraphy. There is appreciated the high diagnostical reliability of scintigraphic pictures, which by its visual property almost unambiguously confirm the localization as well as the extent of focal or expansive lesion, especially in the supratentorial region. Radioisotope cerebral scintigraphy represents an easily performed method which causes no trauma or pain and which has small radiation load and it should be entitled to take first place in the pediatric diagnostics of intracranial lesions. (auth)

22687 COMPARISON BETWEEN RHEOENCEPHALOGRAPHIC DATA ON CEREBRAL CIRCULATION AND ^{133}Xe DETERMINATIONS OF CEREBRAL BLOOD FLOW. Sterman-Marinchescu, C.; Georgeseu, G. (Inst. of Neurology and Psychiatry, Bucharest). Rev. Roum. Neurol.; 10: No. 1, 31-43(1973).

In a group of 30 patients with cerebrovascular stroke, the frequency was calculated, following injection of 20 mg of papaverine hydrochloride, of concordance between changes in cerebral blood flow after xenon-133 inhalation and in REG amplitude (A) relative pulse-volume ($RP^{0}/_{00}$) and between the alterations in parameters of cerebral vascular resistance (CVR) as revealed by either method. Statistically significant correlation was established between the alterations disclosed by REG in A, $RP^{0}/_{00}$, CVR and rise time and those revealed by ^{133}Xe in CBF and CVR. (auth)

22688 USEFULNESS OF RADIONUCLIDES IN RENAL TRANSPLANTATION. De Murphy, C. A.; Tovar Zamora, E. Prensa Med. Mex.; 39: No. 5-6, 247-256(1974). (In Spanish).

The present work is an evaluation of the radioisotopic techniques used in the Nuclear Medicine Department of the Instituto Nacional de la Nutrición in renal transplants. In 13 renal homotransplant recipients, 95 tests were performed during 58 months. The procedures now in use are: 1) dynamic pertecnetate perfusion arteriogram, 2) sequential ^{131}I-hippuran scintigraphy plus the renogram and the cistogram and 3) the ^{131}I-thalamate glomerular filtration rate. The studies were performed immediately after surgery when possible, during the following days, and at 7 and 15 days, at one month, and later on, at various intervals depending on the patient's progress. The methodology is detailed. Normal arteriograms have been obtained in 12 patients on several occasions. In one patient, the kidney was not visualized while in a rejection phase. The combination of the three studies using ^{131}I-hippuran has been of value in assessing: retention loci, partial retention, with flattening of the bladder curve on the rejection phase, and complete retention in a case of ureteral obstruction. Serial studies have been of great value in the evaluation of rejection. The glomerular filtration rate has been used recently with results similar to those obtained with inulin. Even though the number of cases is small the value of the radioisotopic studies has been proven, and will be used routinely in all future cases of renal transplants. (auth)

22689 RADIOIMMUNOASSAY, ACETYLATING RADIOENZYMATIC ASSAY, AND MICROBIOASSAY OF GENTAMICIN: A COMPARATIVE STUDY. Stevens, P.; Young, L. S.; Hewitt, W. L. (Univ. of California, Los Angeles). J. Lab. Clin. Med.; 86: No. 2, 349-359(Aug 1975).

Gentamicin is an aminoglycoside antibiotic widely used to treat gram-negative bacillary infections. Because it has a low therapeutic index, monitoring of serum levels may help to insure adequacy of dosage and avoid toxicity. Microbiological assays are relatively slow and can be complicated by the presence of other antimicrobials. Radioimmunoassay (RIA) and acetylating radioenzymatic assay (ARA) are new methods for gentamicin assay which offer the following advantages: rapidity (less than 3 hours); no interference by other antibiotics; RIA is extremely sensitive and ARA is versatile (being useful in the measurement of other aminoglycosides). Correlation coefficients determined by linear regression analysis of assays on 36 patient samples performed in duplicate on 2 different days demonstrated no significant difference in measurement of gentamicin by each of the methods. Factors such as numbers of specimens, cost, and time involved will affect the decision of the method to be applied in individual laboratories. (auth)

22690 RELIABILITY OF GALLIUM BRAIN SCANNING IN THE DETECTION AND DIFFERENTIATION OF CENTRAL NERVOUS SYSTEM LESIONS. Waxman, A. D.; Siemsen, J. K.; Lee, G. C.; Wolfstein, R. S.; Moser, L. (Univ. of California, Los Angeles). Radiology; 116: No. 3, 675-678(Sep 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Both /sup 99m/Tc-pertechnetate and ^{67}Ga-citrate brain scans were performed in 93 patients with cerebral neoplasms and in 70 others with cerebral infarction or hemorrhage. Tumor detection was clearly better with ^{67}Ga (96 percent) than with /sup 99m/Tc (85 percent). Cerebral infarctions consistently either failed to concentrate ^{67}Ga (67 percent) or revealed a much lower concentration than the /sup 99m/Tc study (27 percent). In 6 percent of the infarction patients, gallium and technetium scans were equivalent. (auth)

22691 CORONARY ANGIOGRAPHIC AND SCINTIGRAPHIC FINDINGS IN EXPERIMENTAL CARDIAC CONTUSION. Chiu, C. L.; Roelofs, J. D.; Go, R. T.; Doty, D. B.; Rose, E. F.; Christie, J. H. (Univ. of Iowa, Iowa City). Radiology; 116: No. 3, 679-683(Sep 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Clinical, angiographic, scintigraphic, and pathologic observations in myocardial contusion were correlated. Radionuclide imaging of the injured heart with /sup 99m/Tc-Sn-polyphosphate provides an accurate diagnosis in acute, even mild, myocardial contusion. The study can be carried out without danger to the critically ill patient. The coronary angiographic findings in this study explain what is occurring pathologically in the heart. Since arteriography is a more invasive technique than radionuclide imaging, its use is recommended only when the image is negative if it is necessary to establish the clinical diagnosis for treatment or when more than one week has elapsed since the injury. (auth)

22692 USE FOR 6 alpha- AND 6 beta-CARBOXYMETHYL TESTOSTERONE-BOVINE SERUM ALBUMIN CONJUGATES IN RADIOIMMUNOASSAY FOR TESTOSTERONE. Jones, C. D.; Mason, N. R. (Eli Lilly and Co., Indianapolis). Steroids.; 25: No. 1, 23-32(Jan 1975).

The synthesis of 6 alpha- and 6 beta-testosterone-bovine serum albumin (BSA) conjugates is described. 6 beta-Carboxymethyl-4-androstene-3,17-dione was prepared by a route analogous to that described earlier for 6 beta-carboxymethyl progesterone. Sodium borohydride reduction of the 3 and 17 keto groups and subsequent selective oxidation of the resulting 3 beta,17 beta-diol using MnO_2 provided 6 beta-carboxymethyl testosterone. Further acid catalyzed epimerization of the C-6 center gave the isomeric 6 alpha-carboxymethyl testosterone. The 6 alpha- and 6 beta-testosterone derivatives were attached to BSA via a mixed anhydride coupling employing tributylamine and i-butylchlorocarbonate. For each molecule of BSA, the 6 alpha- and 6 beta-conjugates contained an average of 23 and 20 steroid residues, respectively. Antisera to the conjugates exhibited similar high specificities toward various steroids, the only incidence of serious cross-reaction being the expected case of dihydrotestosterone. (auth)

22693 CHARACTERIZATION AND PHYSIOLOGICAL VALIDATION OF A RADIOIMMUNOASSAY FOR PLASMA TESTOSTERONE IN THE MALE RAT. Frankel, A. I.; Mock, E. J.; Wright, W. W.; Kamel, F. (State Univ. of New York, Binghamton). Steroids.; 25: No. 1, 73-98(Jan 1975).

A radioimmunoassay (RIA) to measure testosterone concentration in the plasma of male rats was formalized, tested, and physiologically validated. The procedure measured testosterone equally well, whether or not estimation of recovery and chromatographic purification preceded the RIA. The results were equivalent to those achieved by the method of competitive protein binding. No 17beta-hydroxy-5alpha-androstan-3-one was found in the plasma of male rats. Adrenalectomy did not significantly decrease plasma testosterone in either male or female rats. The simplified protocol met all requirements of precision, sensitivity, accuracy, and specificity. A single investigator can analyze 1,000 plasma samples for testosterone in one week if necessary. (auth)

22694 KINETICS OF TRACER FLOWS AND ISOTOPE INTERACTION IN AN ION EXCHANGE MEMBRANE. Li, J. H.; DeSouse, R. C.; Essig, A. (Tufts Univ., Boston). J. Membrane Biol.; 19: No. 1/2, 93-104(22 Oct 1974).

The thermodynamic formulation of isotope interaction (coupling of abundant and tracer isotope flows) has been tested in a highly permselective anion exchange membrane in the absence of significant electroosmosis. A previous study of Cl^- permeation has now been extended to include permeation of I^-, acetate, and SO_4^{2-} in different bath concentrations, with the use of both electrical and chemical driving forces. The flux ratios were abnormal according to the usual criteria for simple passive flow, but were closely predicted by the theoretical expression incorporating the influence of isotope interaction. In the absence of coupled flows of other chemical species the extent of isotope interaction can be determined either from the flux ratio or from the measurement of a single unidirectional flux at two settings of the electrochemical potential difference. Direct evidence of negative isotope interaction was presented. (auth)

22695 BONE MARROW IMAGING USING ^{111}In-CITRATE: ^{111}In-KINETICS IN THE PELVIC REGION. Glaubitt, D. M. H.; Schlueter, I. H.; Haberland, K. U. R. (Staedtische Krankenstalten, Krefeld, Ger.). J. Nucl. Med.; 16: No. 8, 769-774(Aug 1975).

When bone marrow scintigraphy was performed using ^{111}In-citrate, radioactivity was observed in the pudendal region. Subsequently, the kinetics of ^{111}In in the pelvic region after intravenous administration of ^{111}In-citrate for bone-marrow scanning in 14 patients was examined. On the first day, radioindium was found predominantly in the large pelvic blood vessels and in the pudendal region. In all male patients, the scrotal area was affected with both testes presumably delineated in two patients. In the female patients little radioindium was detected in the pudendal region, most probably in the vulva; distinct radioactivity was found in the pelvis although the ovaries could not be identified. In the following period the ^{111}In uptake in the bone marrow increased considerably and reached its maximum usually 24 hr after the injection. Because a distinct radiation dose from ^{111}In to the gonads cannot be excluded on the basis of our scintigraphic findings and the absorbed dose has not yet been estimated sufficiently, judgment should be used for the present if ^{111}In-citrate is applied for bone marrow imaging. (auth)

22696 ^{133}Xe, ^{127}Xe, AND ^{125}Xe FOR LUNG FUNCTION INVESTIGATIONS: A DOSIMETRIC COMPARISON. Goddard, B. A.; Ackery, D. M. (Southampton General Hospital, Eng.). J. Nucl. Med.; 16: No. 8, 780-786(Aug 1975).

On the possible radionuclides of xenon: ^{127}Xe and ^{125}Xe have better physical properties for lung function measurement than ^{133}Xe. A comparison of the radiation doses for these three radionuclides has been made for a typical scintillation camera investigation. Using an exponential model for washin and washout of gas, it is shown that the specific activity–time relationship is always equal to the product of the spirometer concentration and the rebreathing period. It is concluded that of the three radionuclides ^{127}Xe gives the lowest radiation dose during a typical lung function study. (auth)

22697 BASAL GANGLIA SCANS IN THE HUMAN. Skromme-Kadlubik, G.; Diaz, J. F.; Celis, C. (Ciudad Univ., Mexico City). J. Nucl. Med.; 16: No. 8, 787-788(Aug 1975).

Using a ^{64}Cu complex, we obtained human basal ganglia scans in three normal volunteers and in one patient with Wilson's disease with an oral dose of 1 mCi. The method with this new radioactive compound was simple and safe and the results were very encouraging. (auth)

22698 DUAL-CHANNEL FACILITATION OF THE /sup 99m/Tc RADIOCARDIOGRAM. Kaplan, E.; Hochner, G.; Barnes, W. E.; Arnold, J. S.; Shponka, S.; Mayron, L. W.; Frazin, L. (Veterans Administration Hospital, Hines, IL). J. Nucl. Med.; 16: No. 8, 789-792(Aug 1975).

A refinement of the radionuclide-angiocardiogram is described using a low deadtime scintillation camera and hardwire data storage, processing, and display system for the purpose of anatomic definition of the passage of a radioactive bolus through the cardiopulmonary circulation by dual-channel, dual-color, subtraction methodology. The summation of the bolus pathway is displayed as a static frame of reference for the sequential kinetic image. The technique is noninvasive and employs 15 mCi of /sup 99m/Tc pertechnetate. This procedure may be employed as the conventional bolus study for determining the cardiac kinetics ordinarily obtained by the method. The opportunity of viewing the bolus position in relation to its entire pathway significantly facilitates defining the multiple areas of interest the observer may wish to study. (auth)

22699 EVALUATION OF COLD AREAS ON THE THYROID SCAN WITH ^{67}Ga-CITRATE. Heidendal, G. A. K.; Roos, P.; Thijs, L. G.; Wiener, J. D. (Free Univ. Hospital, Amsterdam). J. Nucl. Med.; 16: No. 8, 793-794(Aug 1975).

Cold areas on ^{131}I or /sup 99m/Tc thyroid scans were reevaluated using ^{67}Ga-citrate in 134 patients. In 62 patients, surgical specimens were obtained for histologic studies. Of 46 benign lesions, all had negative ^{67}Ga scans, and ^{67}Ga scans in five of the 16 lesions judged to be malignant were positive. It was thought that the sensitivity of the method did not warrant its use for routine screening in evaluations of malignancy of thyroid nodules. (auth)

22700 IMPROVED BRAIN SCAN SPECIFICITY UTILIZING /sup 99m/Tc-PERTECHNETATE AND /sup 99m/Tc(Sn)-DIPHOSPHONATE. Fischer, K. C.; McKusick, K. A.; Pendergrass, H. P.; Potsaid, M. S. (Massachusetts General Hospital, Boston). J. Nucl. Med.; 16: No. 8, 705-708(Aug 1975).

Each of 36 patients was studied with two separate brain scans performed sequentially after the injection of 20 mCi of /sup 99m/Tc-pertechnetate or 20 mCi of /sup 99m/Tc(Sn)-diphosphonate. The resulting scans were qualitatively compared, and lesion-to-nonlesion ratios of activity determined. Diagnoses were established by clinical criteria and were supported in the majority of cases by computerized axial tomography or roentgen angiography or both. Histologic confirmation was available in five cases of tumor and in the single cases of subdural hematoma and cerebral abscess. Of 22 cerebral infarctions, 15 were better demonstrated with /sup 99m/Tc-(Sn)-diphosphonate than with /sup 99m/Tc-pertechnetate. Of the seven remaining cases, three were visualized equally well with each agent, and three were better demonstrated with /sup 99m/Tc-pertechnetate. One was not seen with either agent. Of the 12 tumors, 11 were visualized better with /sup 99m/Tc-pertechnetate than with /sup 99m/Tc(Sn)-diphosphonate while in one case the lesion was seen equally as well with both agents. In no case was a lesion definitely seen with one radiopharmaceutical and not with the other. These results indicate

that this dual method is helpful in differentiating gliomas and metastases from cerebral infarctions. (auth)

22701 PHAGOCYTIC CAPABILITY OF THE KIDNEY: A POSSIBLE MECHANISM FOR RENAL UPTAKE OF COLLOID IN LIVER–SPLEEN SCANNING. Mikhael, M. A.; Evens, R. G. (Washington Univ., St. Louis). J. Nucl. Med.; No. 16, 8(Aug 1975).

Guinea pigs were given Trypan blue or India ink i.v. and i.m. to demonstrate whether proximal convoluted tubule cells of the normal kidney have potential phagocytic capability. Circulating colloidal particles of Trypan blue solution accumulated in these cells and the accumulation was related to the particle size, dose injection, and duration of experiment. These studies suggest an explanation for the clinical observation of renal visualization with /sup 99m/Tc-sulfur colloid in patients with congestive heart failure. (auth)

22702 IMPROVED DIAGNOSIS OF NONDELINEATED THYROID NODULES BY OBLIQUE SCINTILLATION SCANNING AND ECHOGRAPHY. Blum, M.; Goldman, A. B. (New York Univ., NY). J. Nucl. Med.; 16: No. 8, 713-715(Aug 1975).

The scan of the thyroid gland in oblique projections has enabled us to visualize 11 cold thyroid nodules which were not delineated on a traditional anterior view among 825 patients studied in a 2-yr period. Accurate localization of the nodule in the oblique projection facilitated accurate placement of the transducer for echography. The combination of the isotope imaging studies and ultrasound then permitted one to differentiate solid and cystic cold nodules. Diagnosis and choice of therapy are therefore enhanced by the addition of oblique views, when needed, and echography. (auth)

22703 UNILATERAL VENTRICULAR REFLUX: CASE REPORT. Deisenhammer, E.; Gund, A.; Hammer, B.; Steinhaeusl, H. (State Hospital for Neurology, Psychiatry, and Neurosurgery, Linz, Austria). J. Nucl. Med.; 16: No. 8, 716-717(Aug 1975).

Reflux of ^{131}I-human serum albumin with a dilated ventricle from the contralateral ventricle was observed in a patient with an abnormal cisternogram. (auth)

22704 ENCASEMENT OF THE SPLEEN: CASE REPORT. Johnson, P. M.; Muroff, L. R. (Columbia Univ., New York). J. Nucl. Med.; 16: No. 8, 718-719(Aug 1975).

In a patient with extensive reticulum cell sarcoma involving the abdomen and thorax, encasement of the spleen was demonstrated by scintillation imaging. The features of this observation, not previously reported, and its diagnostic significance are discussed. (auth)

22705 TECHNETIUM /sup 99m/-PYRIDOXYLIDENEGLUTAMATE: A NEW HEPATOBILIARY RADIOPHARMACEUTICAL. I. Experimental Aspects. Baker, R. J.; Bellen, J. C.; Ronai, P. M. (Inst. of Medical and Veterinary Science, Adelaide). J. Nucl. Med.; 16: No. 8, 720-727(Aug 1975).

The labeling of pyridoxal and the pyridoxylidene derivative of glutamic acid with /sup 99m/Tc has been achieved by a simple autoclaving procedure. Technetium-99m-pyridoxylideneglutamate (/sup 99m/Tc-PG) shows marked biliary excretion with accumulation of radioactivity in the gallbladder and intestines of experimental animals. This compound has been extensively investigated with a view to its application in the diagnosis of biliary disorders in man by scintigraphy. Both scintigraphic and quantitative distribution studies showed that /sup 99m/Tc-PG passed rapidly through the mouse liver with progressive accumulation in the gallbladder, allowing visualization of this organ within 10 min of injection. In 30 min over 40 percent of the injected dose excreted into the intestine with an equivalent amount appearing in the urine; however, renal activity remained low. Scintigraphic studies in dogs showed results similar to those obtained in mice. Studies of the toxicity in three animal species indicated a wide margin of safety for /sup 99m/Tc-PG in the dose proposed for diagnostic purposes in humans. (auth)

22706 TECHNETIUM/sup 99m/-PYRIDOXYLIDENEGLUTAMATE: A NEW HEPATOBILIARY RADIOPHARMACEUTICAL. II. Clinical Aspects. Ronai, P. M.; Baker, R. J.; Bellen, J. C.; Collins, P. J.; Anderson, P. J.; Lander, H. (Royal Adelaide Hospital). J. Nucl. Med.; 16: No. 8, 728-737(Aug 1975).

Technetium-99m-pyridoxylideneglutamate (/sup 99m/Tc-PG) is a nontoxic radiopharmaceutical that was found to undergo rapid biliary excretion in normal humans. The biliary tree and gallbladder were seen within 10 to 15 min of injection and by 20 min marked accumulation of radioactivity was noted in the gallbladder and gastrointestinal tract. Of ten control volunteers, seven had normal /sup 99m/Tc-PG-cholescintigrams. In the remaining three, the gallbladder was not visualized. Gallbladder disease was not excluded in these three subjects. The /sup 99m/Tc-PG cholescintigram is suggested for a role complementary to that of contrast radiologic studies in the preoperative investigation of patients with possible surgical disease of the biliary tract. Contrast radiologic techniques are advocated as being more appropriate in the nonjaundiced patient with suspected gallbladder disease whereas the /sup 99m/Tc-PG cholescintigram is advocated as being more appropriate in the patient with jaundice. The value of the /sup 99m/Tc-PG cholescintigram lies in the confidence with which complete extrahepatic biliary obstruction can be diagnosed. The "scintigraphic Courvoisier's sign" seems a useful indicator of malignant obstruction. (ERB)

22707 TECHNETIUM/sup 99m/-METHYLENE DIPHOSPHONATE; A SUPERIOR AGENT FOR SKELETAL IMAGING: COMPARISON WITH OTHER TECHNETIUM COMPLEXES. Subramanian, G.; McAfee, J. G.; Blair, R. J.; Kallfelz, F. A.; Thomas, F. D. (State Univ. of New York, Syracuse). J. Nucl. Med.; 16: No. 8, 744-755 (Aug 1975).

Methylene diphosphonate (MDP) was formulated as a complex of /sup 99m/Tc for skeletal imaging. This agent was compared with three other bone-seeking technetium agents: ethane-1-hydroxy-1, 1-diphosphonate (EHDP), pyrophosphate, and polyphosphate. In tissue radioassay experiments in rodents, the technetium complexes of MDP and EHDP were similar, but skeletal concentration with both of these agents was higher than that with pyrophosphate or polyphosphate. The total-body retention of MDP and EHDP complexed with /sup 95m/Tc was studied in beagle dogs for 35 days by excretion measurements and total-body counting and compared with polyphosphate and pertechnetate. The long-term retention was greater for MDP. The 5-day cumulative fecal excretion of /sup 95m/Tc was low when administered as EHDP or polyphosphate complexes and negligible when administered as MDP complex. In six human volunteers the blood clearance of /sup 99m/Tc-MDP was similar to that of ^{18}F and significantly faster than that of /sup 99m/Tc-EHDP. Pyrophosphate cleared from the blood much faster than polyphosphate but slower than the diphosphonates. The urinary excretion of the MDP complex was greater than for EHDP within the first 2 to 3 hr after injection. The 24-hr urinary excretion of pyrophosphate and polyphosphate complexes was not as complete as for the diphosphonates. All four /sup 99m/Tc complexes proved satisfactory for clinical imaging studies. The MDP complex produced images of superior quality as early as 2 hr after administration, attributable to its more rapid clearance from the blood and soft tissues. On the contrary, a longer interval of 3 to 4 hr after injection was usually needed for /sup 99m/Tc-EHDP; pyrophosphate and polyphosphate complexes regularly required a waiting period of 4 hr. Comparative radiation dose estimates were made based on the available biologic distribution data for these /sup 99m/Tc skeletal-localizing agents. (auth)

22708 INTRATHYROIDAL DEFECTS IN THYROID HORMONE SYNTHESIS: USE OF RADIONUCLIDES IN DIAGNOSIS. Hofeldt, F. D.; Dobbins, W. T.; Block, M. B.; Lufkin, E. G.; Verdon, T. A. (Fitzsimons Army Medical Center, Denver). Rocky Mt. Med. J.; 71: No. 10, 570-575(Oct 1974).

A rational and practical approach to the evaluation of thyroid goiter due to congenital or acquired disease states is presented, using readily available laboratory tests and radionuclide procedures to identify specific defects in thyroid hormone synthesis. Iodine-123, ^{131}I, and /sup 99m/Tc were used for scintiscanning. (HLW)

22709 DIAGNOSTIC SCINTISCANS AND DYNAMIC EXAMINATIONS WITH ^{67}Ga IN PATIENTS WITH SYSTEMIC DISEASE. D'Addabbo, A.; Mele, M.; Fanfani, G.; Damato, V.; Liso, V.; Timurian, A. (Ospedale Policlinico, Bari, Italy). Radiol. Med.; 61: No. 2, 153-159(Feb 1975). (In Italian).

The results obtained with ^{67}Ga in scintiscans and dynamic examinations carried out in 25 patients with systemic disease are presented and discussed. (auth)

22710 COMPARATIVE VALUE OF QUANTIFIED SCINTIGRAPHY AND SEPARATE BRONCHOSPIROMETRY IN APPRAISING THE DISTRIBUTION OF PULMONARY PERFUSION. Anastasatu, C.; Braileanu, A.; Stupcanu, C.; Burnea, D.; Ivanov, G.; Niculescu-Zinca, D.; Pop, T. Med. Interna; 22: No. 1, 39-48(1970). (In Rumanian).

The comparative value of quantitative pulmonary scintigraphy (QPS) and separate bronchospirometry (SBS) for appraising the distribution of pulmonary perfusion was determined. Both determinations were carried out concomitantly, with the different apparatus and quantification methods in three lots of patients, totalling 31 cases. A close agreement was found between QPS and SBS in the lot examined with the Chicago PHO/DOT apparatus, with digital quantification ($r = 0.976\ 26$; $p < 0.001$), and in the lot examined with a SELO apparatus with quantification by the squares method ($r = 0.900\ 03$; $p < 0.001$). Certain discrepancies may be accounted for by the use of obsolete apparatus or quantification methods, or by other identifiable factors. It is concluded that

both QPS and SBS can supply correct information on the distribution of perfusion in the two lungs. (auth)

22711 RADIOTRACER TRANSIT MEASUREMENTS AS AN INDEX OF REGIONAL CEREBRAL BLOOD FLOW. I. Methodological and Clinical Results in Chronic Alcoholics. Dobrzanski, T. (State Hospital, Warsaw). Pol. Przegl. Radiol. Med. Nukl.; No. 2, 201-206(1975). (In Polish).

The numerical mean values of the cerebral radiorheographic index in healthy control subjects and in patients with cerebrovascular disease were not significantly different from the values of regional cerebral blood flow reported, respectively, by other authors using a modification of the ^{133}Xe method. In the group of chronic alcoholics there was a significant correlation between the duration of alcoholism and certain numerical values of the cerebral radiorheographic index. (auth)

22712 DIAGNOSTIC VALUE OF CEREBRAL ARTERIOGRAPHY AND SCINTIGRAPHY. Cernoch, Z.; Kubicek, J.; Kroo, M.; Malec, R.; Rozsival, V.; Parizek, J. (Karlova Univ., Hradec Kralove, Czech.). Sb. Ved. Pr. Lek. Fak. Karlovy Univ. Hradci Kralove.; 16: No. 4-5, 267-272(1973).

In the group of 52 patients, suspected of an expansive intracranial lesion, the results of the brain scanning were falsely negative in 11.5% of cases. The arteriography, though giving more valuable findings than the scintigraphy only in 15%, was always positive in space occupying lesions, even when sometimes only slightly positive. In 23% the scan finding was more marked, more perfect, and more illustrative concerning the localization and extent of the expansion than the angiography. The used method of conventional scintigraphy is not able to solve the question whether the registered active nodule is of an expansive character and does not help in solving the etiological diagnosis of the process. Scintigraphy, technically simple and well tolerated method, has given with cerebral angiography an exact preoperative diagnosis of brain expansion in 88.5% of investigated patients. In a great number of these, pneumoencephalography or ventriculography was not necessary. (auth)

22713 STUDY OF ^{99m}Tc-POLYPHOSPHATE AS A JOINT IMAGING AGENT. Blake, K.C.H.; Shepstone, B. J.; Goldberg, S. (Groote Schuur Hospital and Univ., Cape Town). S. Afr. Med. J.; 48: No. 55, 2292-2294(13 Nov 1974).

This study shows an example of the pronounced uptake of ^{99m}Tc-polyphosphate in the hand joints of a patient with rheumatoid arthritis. Bone-labelling and blood-labelling radioisotopes, ^{18}F and ^{113m}In respectively, have been used to help establish, image-wise, the site of uptake in the joints. A comparison of the joint uptake of ^{99m}Tc-polyphosphate with that of ^{99m}Tc has also been made, and shows that ^{99m}Tc-polyphosphate is superior in this aspect. The use of ^{99m}Tc-polyphosphate as a joint agent is suggested. (auth)

22714 COMPARATIVE STUDY OF THE GAMMA CAMERA AND RECTILINEAR SCANNER FOR DETECTION OF SUPERFICIAL LESIONS. Stevens, P. P.; Blake, K.C.H.; Shepstone, B. J. (Groote Schuur Hospital and Univ., Cape Town). S. Afr. Med. J.; 48: No. 55, 2295-2298(13 Nov 1974).

A study has been made comparing the performance of the gamma camera and rectilinear scanner in detecting the presence of a superficial brain lesion. Experiments were conducted to compare resolution and sensitivity of both devices; they showed that at the usual distance of a superficial lesion from the collimators of the devices, the gamma camera had superior resolution and sensitivity. Both patient and phantom studies were performed, which demonstrated the superiority of the gamma camera, and it is suggested that if superficial lesions are suspected, the gamma camera should be used for imaging these lesions. (auth)

22715 RADIOTRACER TRANSIT MEASUREMENTS AS AN INDEX OF REGIONAL CEREBRAL BLOOD FLOW. II. Results in Acute Alcohol Withdrawal Syndromes. Dobrzanski, T. (Internal Dept. for Mental Patients, Warsaw). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 2, 207-213(1975).

The data obtained in 72 male chronic alcoholics with acute alcohol withdrawal syndromes give evidence that there is a significant correlation between the numerical value of the cerebral radiorheographic index and the severity of the psychopathological syndrome (especially of the clouding of sensorium) in these patients. (auth)

22716 RADIOHIPPURAN RENOGRAPHY IN CHRONIC ALCOHOLICS WITH ACUTE ALCOHOL WITHDRAWAL SYNDROMES. Dobrzanski, T. (Internal Dept. for Mental Patients, Warsaw). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 2, 215-220(1975).

Functional changes found in radiohippuran renography in chronic alcoholics with acute alcohol withdrawal syndromes (n = 82; AAWS) regressed to normal values with recovery from AAWS (during 4 days on the average) with the exception of the secretory value which increased to a maximum on the 7th day of observation, remaining approximately unchanged for the following 3 days and decreasing more gradually to a normal value on the 23rd day of observation. In various forms of AAWS the same functional changes in the radiohippuran renogram were observed. (auth)

22717 USE OF UNITHIOL FOR REDUCING RADIATION HAZARD OF RENAL SCINTIGRAPHY WITH CHLORMERODRIN ^{203}Hg. I. Estimation of the Urinary Excretion of ^{203}Hg. Oginski, M.; Kloczkowski, K. (Research Centre of the Medical Academy, Lodz, Poland). Int. Urol. Nephrol.; 5: No. 4, 371-376(1973).

The authors presented a method for reducing renal irradiation during ^{203}Hg-chlormerodrin scintigraphy. Renal excretion of ^{203}Hg was speeded up by Unithiol (U. S. S. R.) which was administered immediately after scintigraphy. The investigations concerned nine patients who received i.m. 1 ampoule of Unithiol every 12 hours for 3 days. The activity of urine and per cent of excreted ^{203}Hg were measured. An average increase by 34.8% in urinary ^{203}Hg excretion was found after Unithiol administration in comparison to the control group of persons in whom the preparation was not applied. (auth)

22718 PHYSICAL ASPECTS OF ^{99m}Tc, ^{87m}Sr, AND ^{18}F FOR BONE SCINTIGRAPHY. Van Aswegen, A.; Loetter, M. G.; Iturralde, M.; Van Zyl, W. H.; Anderson, J. D.; Minnaar, P. C. (Univ. of the Orange Free State, Bloemfontein, South Africa). S. Afr. Med. J.; 48: No. 55, 2283-2288(13 Nov 1974).

The physical properties of ^{99m}Tc, ^{87m}Sr, and ^{18}F as bone scanning agents for a scintillation camera fitted with a medium energy diverging collimator, were determined. This was done by incorporating the plane source sensitivity, the modulation transfer function, and the figure of merit. From the results it is clear that ^{99m}Tc is superior to ^{87m}Sr and ^{18}F. (auth)

22719 POSSIBILITIES OF THE STUDY OF REGIONAL BLOOD FLOW THROUGH THE BRAIN USING ^{99m}Tc SODIUM PERTECHNETATE. Rohacek, J.; Petr, R. (Karlova Univ., Hradec Kralove, Czech.). Sb. Ved. Pr. Lek. Fak. Karlovy Univ. Hradci Kralove.; 16: No. 4-5, vp(1973).

The measurement of the rate of blood flow by means of intravenous application of the radionuclide ^{99m}Tc in the form of sodium pertechnetate is a method making little demand on the patient, connected with low radiation load. The shape of the curve is determined primarily by the rate of blood flow; other conclusions can only be made with caution. (auth)

22720 METHOD FOR THE INVESTIGATION OF GASTRIC EMPTYING BY MEANS OF AN ^{113m}In EMITTER, SCINTILLATION CAMERA, AND WHOLE-BODY SCANNER. Silar, J.; Skala, I.; Mikusova, M.; Krajska, V.; Prokopec, J.; Smidova, M.; Mottl, V.; Pirk, F.; Skala, J. (Karlova Univ., Prague). Rev. Czech. Med.; 20: No. 4, 189-200(1974).

For investigations of the gastric emptying by means of an ^{113m}In emitter added to a milk test meal, a scintillation camera PHO GAMMA III, and a whole-body scanner MULTISCAN were used. The method renders it possible to evaluate gastric emptying quantitatively fairly accurately. Examinations of a large group of patients with various diseases of the digestive tract revealed that the generally accepted idea of a simple exponential course of gastric emptying ensued from simplified experimental and methodological conditions and applies only in special cases. (auth)

22721 CORRELATION BETWEEN THE PATHOLOGICAL FINDINGS AND THE GAMMAGRAM OF THE THYROID, BRAIN, AND LIVER. Murphy Stack, E. Prensa Med. Mex.; 39: No. 5-6, 262-265(1974). (In Spanish).

The present concepts on the correlation existing between pathological findings and gammagraphic indications are discussed on the basis of results reported in the literature for the thyroid, brain, and liver. It is concluded that the results obtained from nuclear medical tests should be considered in conjunction with other tests and with clinical data. (JSR)

22722 DELAYED HEPATIC GAMMOGRAM WITH IONIC ^{113m}In IN THE DIAGNOSIS OF MALIGNANT LESIONS. Rodriguez, F. C.; Gordon, G. F.; Narvaez, N. M. A. Prensa Med. Mex.; 39: No. 5-6, 257-258(1974). (In Spanish).

Preliminary data are presented on the delayed use of ionic ^{113m}In to show the concentration of radioactivity in the interior of lesions, principally in cases previously considered negative. The results reported were obtained on 13 patients in which one or more defects were observed in the uptake of colloidal ^{113m}In. Ionic form of the isotope was administered and scintillograms were obtained to study the vascularization of the lesion. Six hours later another scintillogram was taken to visualize the impregnation of the radioactive material in the interior of the lesion. In all cases the diagnosis was confirmed by other methods. The mechanism for the uptake was discussed. (JSR)

22723 SCINTILLOGRAPHY OF RENAL TUBERCULOSIS. Lopez, R. M. A.; Narvaez, N. M. A.; Cuaron, S. A.; Trevino, B. A. Prensa Med. Mex.; 39: No. 5-6, 241-243(1974). (In Spanish).

Results are reported on the scintillographic examination, using ^{203}Hg-neohydrin, of 10 patients with renal tuberculosis. The results showed that this technique is useful in establishing the degree of damage in the renal parenchyma and can be used in evaluating the evolution of the illness. (JSR)

22724 RADIOIMMUNOLOGIC ASSESSMENT OF THE LEVEL OF CIRCULATING LH ANTIBODIES AFTER PASSIVE IMMUNIZATION IN THE RAT: RELATION TO THE LEVEL OF LH SECRETION. Morishige, W. K.; Billiar, R. B.; Rothchild, I. (Case Western Univ., Cleveland). Endocrinology; 96: No. 6, 1437-1446 (Jun 1975).

A double antibody radioimmunologic technique was used to estimate circulating levels of free LH antibodies (Ab) (i.e., Ab available for binding to radioiodinated rat LH in vitro) after a single injection of an equine antiserum to bovine LH (LH-AS) into cyclic (diestrus-1), early pregnant (d 6 or d 8), short-term (1 d) or long-term (12 d) ovariectomized, or 8-d hypophysectomized female rats. In both cyclic and pregnant rats given 0.5 ml LH-AS SC the blood Ab levels peaked 1 to 2 days after injection and then decreased exponentially (half-time: 14.6 to 17.0 h) and equally; vaginal estrus also appeared in the cyclic and in the aborting pregnant rats on the 6th day, and ovulation on the 7th day after LH-AS treatment, when the blood levels had fallen to very low values. The rate of exponential decrease in blood Ab levels was not affected by other routes of administration (iv or ip) of LH-AS, or by SC doses of 1.0 or 0.25 ml, although the peak levels and their duration were related to dose and route of administration. Ovariectomy significantly increased the rate of exponential Ab decrease (half-time: 9.8 h in rats tested 12 days after operation) and hypophysectomy markedly diminished it (half-time: 63.0 h in rats tested 8 days after operation). Daily treatment of hypophysectomized rats with 20 mu g/day of ovine LH from the time of LH-AS injection increased the rate of exponential Ab decrease to one approaching that of the intact rats (half-time: 20.5 h). Free LH antibodies thus seem to disappear from the circulation at a rate proportional to the amount of LH in the circulation. (auth)

22725 PREOPERATIVE BONE SCANS. Charkes, N. D.; Malmud, L. S.; Caswell, T.; Goldman, L.; Hall, J.; Lauby, V.; Lightfoot, W.; Maier, W.; Rosemond, G. (Temple Univ., Philadelphia). J. Am. Med. Assoc.; 233: No. 6, 516-518(11 Aug 1975).

Strontium nitrate Sr-87m bone scans were made preoperatively in a group of women with suspected breast cancer, 35 of whom subsequently underwent radical mastectomy. In 3 of the 35 (9 percent), the scans were abnormal despite the absence of clinical or roentgenographic evidence of metastatic disease. All three patients had extensive axillary lymph node involvement by tumor, and went on to have additional bone metastases, from which one died. Roentgenograms failed to detect the metastases in all three. Occult bone metastases account in part for the failure of radical mastectomy to cure some patients with breast cancer. It is recommended that all candidates for radical mastectomy have a preoperative bone scan. (auth)

22726 MEASUREMENT OF PULMONARY CLEARANCE IN MAN WITH LABELED IRON OXIDES. Le Bouffant, L.; Henin, J. P. (Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR), 60 - Creil). pp 193-204 of Reactions Bronchopulmonaires aux Polluants Atmospheriques. Paris, France; Institut National de la Sante et de la Recherche Medicale (1974). (In French).

From colloquium on broncho-pulmonary reactions to airborne pollutants; Pont-a-Mousson, France (18 Jan 1974).

The development of a method for measuring pulmonary retention and clearance in man has as its goal: to determine the individual's ability to remove inhaled particulate pollutants thus assessing the individual risk; to watch the evolution of the clearance capacity in the case of multiple exposures; to detect and to observe the evolution of certain lesions, and reciprocally to determine their influence on the clearance capacity. The method consists in having the persons concerned inhale a small dose of ^{59}Fe-labeled hematite and measuring the removal of intrapulmonary dust by external counts of rays emitted by the radioactive source. The apparatus comprises an inhalation unit and a counting block. The aerosol is obtained by dispersing (by compressed air) dry particles of hematite in an inflatable balloon which is connected to the inhalation circuit. For the counting, use is made of a plastic high sensitivity scintillation counter applied on the dorsal column of the person in a horizontal position. The quantity of hematite used is about 10 μCi. The counts are made at intervals and plotted to obtain the clearance curve. From the first results it appears that total retention and alveolar retention vary considerably for different persons. This is shown by the clearance velocity corresponding to the long-term phase, for which the extreme values obtained (in three persons) are in the ratio of 5. (FR)

22727 ISOTOPE ANGIOGRAPHY IN PERIPHERAL ARTERIAL DISEASE. Chapuis, Y.; Comet, M.; Roucayrol, J. C.; Leger, L. (Hopital Cochin, 75 - Paris (France)). Nouv. Presse Med.; 4: No. 16, 1189-1193(19 Apr 1975). (In French).

On the basis of 67 isotope angiograms, the results of which were compared with those of arteriography, the advantages, indications, and limitations of this technique are presented. (FR)

22728 RISA (^{131}I) SCANNING OF CEREBROSPINAL FLUID PATHWAYS IN CHILDREN WITH MYELOMENINGOCELE. Upadhyaya, P.; Goswamy, H. L.; Rohatgi, M.; Basu, A. K.; Rao, M. A. P. (All-India Inst. of Medical Sciences, New Delhi). Dev. Med. Child. Neurol.; 16: No. 6, 144-151(Dec 1974).

The results are presented of intraventricular and intrathecal RISA studies in 25 children with myelomeningocele. Scans of the head and neck were done in all cases, and in five patients composite scans were done to cover the head, neck and trunk. The observations define the abnormal pathways of cerebrospinal fluid circulation from the lateral ventricles to the basal cisterns via the central canal, the myelomeningocele sac, and the spinal theca. It appears that three sets of abnormal mechanical factors may be responsible for stasis in the flow of cerebrospinal fluid: caudal migration of the hindbrain, mechanical blockage at the site of the myelomeningocele sac, and subarachnoid blockage at the level of the tentorium cerebelli. There is an evident need for the development of primary reconstructive surgical procedures to restore the normal cerebrospinal fluid pathways. (auth)

22729 GALLIUM SCANNING AS A SCREENING TEST FOR INFLAMMATORY LESIONS. Teates, C. D.; Hunter, J. Jr. (Univ. of Virginia, Charlottesville). Radiology; 116: No. 2, 383-387(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Of the ^{67}Ga scans obtained in 42 patients with fever and suspected inflammatory lesions, 17 were positive. In nine patients the scans yielded information about localized inflammation not provided by previous studies. Four patients did not have an inflammatory lesion at the positive site. Ten of 13 abscesses or inflamed wounds visualized and those not demonstrated were resolving without complication. Scans were normal in most patients with viral illnesses and nonlocalized inflammatory lesions. In eight of nine patients with fever of unknown origin the scan was normal. A normal scan did not rule out inflammatory lesions but no significant localized pyrogenic lesions were missed. (auth)

22730 CLINICAL EVALUATION OF TUMOR SCANNING WITH ^{169}Yb-CITRATE. Hisada, K. (Kanazawa University Hospital, Japan); Suzuki, Y.; Hiraki, T.; Sano, H.; Suzaki, K. Radiology; 116: No. 2, 389-393(Aug 1975).

Ytterbium-169 citrate was used as the tumor-scanning agent in 360 patients with malignant tumors and in 55 others with benign lesions and the results compared with ^{67}Ga-citrate studies in other series. In malignant tumors, the overall positive detection rate for ytterbium was 65.3 percent; in benign lesions, the false-positive rate was 29.1 percent. Good results were obtained in the extremities, head and neck, and pelvic area. Of all tumors visualized, squamous cell carcinoma was detected most effectively (77.5 percent). Ytterbium-169 citrate has a long shelf life, photon peaks of 178 and 198 keV, clears from the blood more rapidly than ^{67}Ga-citrate, and has an extremely low soft-tissue background uptake. Its main disadvantage is its high radiation dose: 1.74 R/500 mu Ci whole-body and 5.77 R to the bone. (auth)

22731 TUMOR LOCALIZATION OF ^{131}I-LABELED ANTIBODIES BY RADIONUCLIDE IMAGING. Ghose, T.; Tai, J.; Aquino, J.; Guclu, A.; Norvell, S.; MacDonald, A. (Dalhousie Univ., Halifax, Nova Scotia). Radiology; 116: No. 2, 445-448 (Aug 1975).

Intravenous injections of ^{131}I-labeled anti-EL4 lymphoma antibodies showed progressive localization of radioactivity in EL4 transplants but not in B16 melanoma in mice carrying both tumors. Normal rabbit globulin labeled with ^{131}I did not localize in either tumor and cleared more slowly from the internal organs. Metastatic localization of intravenous ^{131}I-labeled anti-tumor antibodies was also observed in two cancer patients. (auth)

22732 RELATIVE EFFICACY OF RADIONUCLIDE IMAGING AND COMPUTED TOMOGRAPHY OF THE BRAIN. Pendergrass, H. P.; McKusick, K. A.; New, P.F.J.; Potsaid, M. S.

(Massachusetts General Hospital, Boston). Radiology; 116: No. 2, 363-366(Aug 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Computed tomography (CT) with the EMI scanner has been demonstrated to possess a wide spectrum of capabilities in the diagnosis of suspected intracranial disease. This review of 418 dual CT and radionuclide (RN) brain images indicates that RN and CT are complementary in the diagnosis of cerebral infarction, but that CT has a greater capability in brain tumor detection. The classical RN static brain image does not detect cerebral atropy, hydrocephalus, or intraventricular hemorrhage; these conditions are clearly defined by CT. (auth)

22733 BRAIN SCANNING IN OLIGODENDROGLIOMAS. Schall, G. L. (National Inst. of Health, Bethesda, MD); Heffner, R. R.; Handmaker, H. Radiology; 116: No. 2, 367-372(Aug 1975).

Thirty-six brain scans and biopsies from 34 patients with histologically verified oligodendrogliomas were evaluated. Twenty-nine of the 36 scans were positive (80.6 percent) but the abnormal uptake produced by these neoplasms had no distinguishing features. The levels of endothelial proliferation-vascularity, necrosis, and mitoses were significantly different between the positive and negative scans. In the oligodendrogliomas, the relationship between histologic malignancy, detectability on scan, and prognosis remains unresolved. (auth)

22734 EARLY EXPERIENCE WITH THE EMI SCANNER FOR STUDY OF THE BRAIN. Baker, H. L.; Campbell, J. K.; Houser, O. W.; Reese, D. F. (Mayo Clinic, Rochester, MN). Radiology; 116: No. 2, 327-333(Aug 1975).

From 10th neuroradiological symposium; Punta del Este, Uruguay (10 Mar 1974).

Computed tomography of the head is a highly accurate new radiologic technique for the evaluation of neurologic disease. Analysis of early cases indicates that the appearance produced by CT in some conditions is unique and that increasing experience allows the neuroradiologist to predict the position and nature of disease processes with greater accuracy. (auth)

22735 RADIOIMMUNOASSAY OF DIGOXIN: ASPECIFIC INTERFERENCES OF HUMAN PLASMA. Padeletti, L. (Univ., Florence). J. Nucl. Biol. Med.; 19: No. 1, 22-28(1975).

A radioimmunoassay for determination of digoxin in human plasma is described. After extraction of plasma with ethyl acetate, the radioimmunoassay is performed using an antiserum to digoxin-BSA and charcoal. Precision, accuracy, sensitivity, and specificity were evaluated. The comparison with two methods based on the direct measurement of digoxin without extraction showed the presence of aspecific interferences coming from human plasma when plasma samples are not extracted. (auth)

22736 EFFECT OF DEXAMETHASONE ON TRI-IODOTHYRONINE (T_3) RESPONSE TO TSH. Vigneri, R.; Filetti, S.; Galbiati, V.; Pezzino, A.; Squatrito, S.; Polosa, P. (Ospedale Garibaldi, Catania, Italy). J. Nucl. Biol. Med.; 19: No. 1, 29-31(1975).

Short-term dexamethasone treatment (8 mg/day for 3 days) resulted in a significant decrease of T_3 plasma levels in all the 10 euthyroid subjects examined. In addition, in all of them the T_3 response to exogenous bovine TSH (5 I.U. intramuscularly) was impaired. This study demonstrates that dexamethasone treatment reduces the total T_3 concentration in plasma before and after TSH. The mechanism of dexamethasone effect on T_3 levels is not clarified by the present study: in fact, both a blunted production rate and/or an increased distribution volume might account for the lowered T_3 concentration. (auth)

22737 PRELIMINARY APPLICATIONS OF DIGITAL FILTERING IN ADRENAL SCAN. Guzzardi, R.; Veratti, R.; Torsoli, A. (Univ., Pisa, Italy). J. Nucl. Biol. Med.; 19: No. 1, 36-38(1975).

The problems related to adrenal scan with particular reference to the importance of image quality for both morphological and functional evaluation are described. Some preliminary applications of the automatic digital filtering technique (Wiener filtering) are shown. (auth)

22738 SUPPURATIVE SPONDYLITIS WITH PELVIC ABCESS: LOCALIZATION BY ^{67}Ga SCANNING. Ferrannini, E.; Navalesi, R. (Univ., Pisa, Italy). J. Nucl. Biol. Med.; 19: No. 1, 39-44 (1975).

The case of a young man admitted because of fever of unknown origin and moderate splenomegaly is described. Routine investigations failed to provide any clues to the diagnosis. A ^{67}Gallium abdominal scan revealed massive uptake in the left pelvic area. On this basis surgical exploration demonstrated a non-tuberculous psoas abscess springing from the lumbar spine. Gallium-67 citrate is confirmed as a useful scanning agent for detection of infectious processes. (auth)

22739 EXPERIMENTAL STUDY OF THE CONCENTRATION OF TUMOR TRACERS IN NON-MALIGNANT LESIONS. De Roo, M. J. K. (Univ., Louvain, Belgium). J. Nucl. Biol. Med.; 19: No. 1, 5-11(1975).

The experimental study of radioactive accumulation in non-malignant lesions demonstrated that tumor tracers are very effective for detection and visualization of aseptic and infectious abscesses in animals. For some tracer substances, the results indicated even higher uptake values (in % dose % body weight) and higher lesion/blood ratios in comparison with measurements in experimental tumors. This is particularly the case with ^{206}Bi-acetate, ^{57}Co-bleomycin, and ^{67}Ga-citrate, generally considered as good tumor tracers. As suggested by Blair and co-authors, the forementioned tracer substances could be used for scintigraphic localization of infectious processes. On the contrary, hematomas present low tracer accumulation. Using some tracers, however, a scintigraphic visualization is not excluded, owing to the high accumulation ratio versus surrounding tissues. (auth)

22740 CORONARY ARTERIAL INJECTION OF RADIOACTIVE ALBUMIN MICROSPHERES IN DIAGNOSIS OF EXPERIMENTAL MYOCARDIAL CONTUSION. Ware, R. E.; Martin, L. G.; Tyras, D. H.; Kourias, E.; Symbas, P. N. (Emory Univ., Atlanta). Surg. Forum; 23: 138-139(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

Modern high-speed travel has resulted in an increased incidence of myocardial contusion. The diagnosis of this entity has depended upon electrocardiographic abnormalities which are relatively nonspecific and frequently precipitated by other conditions. The purpose of this study was to investigate the feasibility and hazards of cardiac scanning, using /sup 99m/Tc (technetium)-labeled albumin microspheres (AM) (particle size of 15 to 30 mu) in the diagnosis of experimental myocardial contusion. (auth)

22741 RADIONUCLIDE VENOGRAPHY: RAPID DYNAMIC VISUALIZATION OF THE VENOUS SYSTEM. Barns, R. W.; Hamilton, G. W.; McDonald, G. B.; Rudd, T. G.; Nelp, W. B.; Strandness, D. E. Jr. (Univ. of Washington, Seattle). Surg. Forum; No. 23, 236-237(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

Although contrast phlebography remains the diagnostic standard for detection of thrombophlebitis, patient discomfort and other factors limit routine use of venography for screening or follow-up purposes. Furthermore, the iliofemoral veins and vena cava are not routinely visualized with this technique. This investigation assessed a relatively simple radionuclide method to visualize the major veins of the lower extremities and abdomen. (auth)

22742 CLINICAL USEFULNESS OF LEG SCANNING WITH RADIOACTIVE MICROSPHERES IN ARTERIAL INSUFFICIENCY. Gardner, T. J.; Greyson, N. D.; Rhodes, B. A.; Williams, G. M. (Johns Hopkins Univ., Baltimore). Surg. Forum; 23: 247-249(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

The presence of hyperemia detected by this technique in an ulcer or associated with a gangrenous digit is a reliable criterion of healing potential, particularly in the absence of pedal pulses. Neither the presence of diabetes nor the absence of pedal pulses correlated with the pattern of blood flow seen by scan or with their potential for healing. The technique deserves clinical application. (auth)

22743 PULMONARY FUNCTION STUDIES WITH XENON-133 AFTER ORTHOTOPIC CARDIOPULMONARY AUTOTRANSPLANTATION IN PRIMATES. Schmidt-Habelmann, P.; Hornung, J.; Ponto, R.; Loken, M. K.; Zamora, R.; Castaneda, A. R. (Univ. of Minnesota, Minneapolis). Surg. Forum; 23: 277-279(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

Orthotopic cardiopulmonary autotransplantation is compatible with prolonged survival in primates. The bilaterally denervated lungs are capable of supporting life without respiratory assist immediately after surgery. Xenon-133, used in conjunction with the scintillation camera, proved a convenient and sensitive technique for the evaluation of early and late pulmonary functions in these nondomesticated primates. (auth)

22744 ISOTOPIC ANTIGLOBULIN ASSAY EMPLOYING CELL MONOLAYERS. Burdick, J. F.; Cohen, A. M.; Ketcham, A. S.; Wells, S. A. Jr. (National Cancer Inst., Bethesda, MD). Surg. Forum; 23: 296-298(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

A greatly simplified isotopic antiglobulin assay has been developed which utilizes monolayer tissue culture cells and is sufficiently sensitive to detect HL-A alloantibody. (auth)

22745 VISUALIZATION OF RETAINED ANTRUM WITH TECHNETIUM. Safaie-Shirazi, S.; Chadhuri, T.; Chaudhuri, T.; Condon, R. E. (Univ. of Iowa, Iowa City). Surg. Forum; 23: 332-333(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

The studies indicate that secretion of technetium is a property of both antral and fundic gastric mucosa. The mechanism of secretion is not mediated only by parietal cells. In this animal investigation, technetium scanning appeared to be both reliable and sensitive in identifying retained antrum. Small cuffs of antral mucosa only 1 cm in axial dimension were regularly visualized. (auth)

22746 RADIOIODINATED ROSE BENGAL KINETICS IN EXTRAHEPATIC BILIARY OBSTRUCTION AND HEPATIC HOMOGRAFT REJECTION IN THE DOG. Launois, B.; Corman, J. L.; Porter, K. A.; Ryerson, T.; Bostrom, S.; Gustafsson, A.; Groth, C. G.; Starzl, T. E. (Univ. of Colorado, Denver). Surg. Forum; 23: (1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

The present data suggest that differentiation between homograft rejection and total extrahepatic biliary obstruction can be aided by studying the kinetics of radioactive rose bengal. In dogs with moderate rejection as well as in dogs with obstruction, the intravascular retention values and the radiographic liver picture were very similar, but only the former animals had excretion of the dye into the bowel. When rejection became advanced, bowel excretion was inconsistent, presumably due to severe intrahepatic cholestasis, but at this stage the retention values were higher than those recorded after obstruction. Data from seven human recipients of orthotopic hepatic homografts are consistent with the findings in the dogs. (auth)

22747 RADIOIMMUNOASSAY OF CHOLECYSTOKININ. Reeder, D. D.; Becker, H. D.; Smith, N. J.; Rayford, P. L.; Thompson, J. C. (Univ. of Texas, Galveston). Surg. Forum; 23: 361-362(1972).

From 58th annual clinical congress; San Francisco, CA (Oct 1972).

In our newly developed radioimmunoassay technique for measurement of physiologic levels of CCK, serial dilutions of postprandial human and dog serum reacted in a parallel manner to the CCK reference preparation in the assay system, but there was no cross-reaction with caerulein, gastrin, pentagastrin, or secretin. Circulating serum CCK levels in five normal people were 6.9 to 23.3 ng/ml. In dogs, intrajejunal instillation of L-phenylalanine or fat results in increased serum CCK levels in the mesenteric vein. (auth)

22748 ^{125}I-LABELED FIBRINOGEN SCANNING. Use in the Diagnosis of Venous Thrombosis. Hirsh, J. (McMaster Univ., Hamilton, Ont.); Gallus, A. S. J. Am. Med. Assoc.; 233: No. 9, 970-973(1 Sep 1975).

Venous thrombosis is often asymptomatic in patients in whom major pulmonary embolism develops. When used expectantly, iodine-125-labeled fibrinogen scanning is a very sensitive method for detecting subclinical leg vein thrombi. Fibrinogen scanning is less useful for the diagnosis of established venous thrombosis, but is valuable for detecting extension of venographically diagnosed calf vein thrombosis. The technique is safe if fibrinogen is obtained from carefully screened donors. The limitations of the method include its inability to distinguish between superficial and deep venous thrombi, and its sensitivity to fibrin in hematoma and inflammatory exudates. Though the results agree closely with those of phlebography, scanning seems less reliable for detecting femoral vein than calf vein thrombi and is insensitive to thrombi above the inguinal ligament. Screening for these major thrombi may be improved by combining fibrinogen scanning with impedance plethysmography or ultrasonic examination. (auth)

22749 SIMPLE RADIO-IMMUNOASSAY FOR THE MEASUREMENT OF HUMAN AND RAT IgE LEVELS BY AMMONIUM SULFATE PRECIPITATION. Carson, D.; Metzger, H.; Bazin, H. (National Institutes of Health, Bethesda, MD). J. Immunol.; 115: No. 2, 561-563(Aug 1975).

A simple assay for quantitating IgE levels has been developed based on the observation that antibody-bound IgE is insoluble in 33 percent saturated $(NH_4)_2SO_4$ whereas unbound IgE is not. The method has been applied to human and rat IgE. Some preliminary results on IgE levels in parasite-injected rats are presented. (auth)

22750 VALUE OF RADIOISOTOPE INVESTIGATIONS IN ASSESSMENT OF THE EXTENT OF OPERATIONS IN NON-TOXIC NODULAR GOITRE. Woy-Wojciechowski, J.; Krzeminska, T.; Rusiniak, L.; Wieczorek, K. Pol. Tyg. Lek.; 29: No. 38, 1609-1603(23 Sep 1974). (In Polish).

The results were evaluated of surgical treatment in a group of patients with non-toxic nodular goitre in whom radioisotope studies were carried out before and 3 to 15 months after the operation. The studied group included 118 patients in whom radioisotope tests were done with ^{131}I. The first group included 20 patients in whom unilateral nearly complete strumectomy was performed while in the second group bilateral nearly total strumectomy was done. The authors consider that a comparison of clinical investigations with the results of control radioisotope examinations is quite sufficient for assessment of the postoperative state of the patients and thyroid function. In some cases, however, additional investigations should be done such as suppression test with triiodothyronine or thyroidin, stimulation test with TSH administration, tyroxine level, and PBI determinations. (auth)

22751 EFFECT OF INTRAARTICULAR HYDROCORTISONE INJECTIONS ON HEALTHY RAT JOINTS. I. Incorporation of ^{35}S Sulfates into Glucosaminoglycans of Articular Connective Tissue. Gietka, J.; Krzakowski, Z. Pol. Arch. Med. Wewn.; 53: No. 1, 33-38(Jan 1975). (In Polish).

Using the isotope with ^{35}S sodium sulphate, the changes in connective tissue glucosaminoglycans were studied in knee joints of rats after topical injections of hydrocortisone. It was demonstrated that the incorporation of sodium sulphate into articular connective tissue glucosoaminoglycans was raised in relation to control animals. The possible mechanisms responsible for the increase in the content of glucosaminoglycans after intra-articular injections of hydrocortisone are discussed. (auth)

MATERIALS

22752 (CONF-701074-P3) PROCEEDINGS OF THE SCIENTIFIC-TECHNICAL CONFERENCE "ATOMIC POWER, FUEL CYCLES, RADIATION STUDY OF MATERIALS", ULYANOVSK, 5-10 OCTOBER 1970. Vol. 3. 1970. Translation of Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III. 807p. Dep. NTIS $13.60.

Twenty-nine papers were presented at the conference. A separate abstract was prepared for each paper. (JRD)

For abstracts of individual papers see: 22757, 22817, 22828, 22843-22846, 22906-22915, 22923, 23553, 23570, 23659-23661, 23671-23674, 24010, and 24019.

22753 (RD/B/N-3358) UNIFIED APPROACH TO ELASTIC-PLASTIC FRACTURE MECHANICS. Neale, B. K.; Townley, C. H. A. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). May 1975. 48p. Dep. NTIS (US Sales Only) $5.50.

To assess the integrity of a cracked structure, using materials data obtained from simple laboratory tests, it is essential to define materials properties which are independent of the shape and the size of the specimen and of the loading system applied to it. In those situations where either the specimen or the structure fails after significant yielding has taken place, there is considerable speculation about the materials parameters which are relevant. By extending the Griffith equation for the stability of a perfectly elastic cracked body, a fracture criterion which is applicable in the post yield regime is derived. Comparisons are made with procedures based on the J-contour integral, equivalent energy, and crack opening displacements and with the post yield fracture mechanics of Heald, Spink and Worthington, and Dowling and Townley. For certain materials, it is shown that the factor controlling crack initiation is the fracture toughness K_{Ic}, irrespective of the amount of prior plastic damage, and hence independent of the shape and size of the specimen tested. Load carrying capacity in the post yield regime cannot, however, be derived directly from a knowledge of fracture toughness; the ultimate tensile strength of the material is also relevant. (auth)

22754 DIFFUSION OF LINEARLY DISTRIBUTED MATERIAL IN AN EVAPORATING SLAB. Sy Ong, A.; Teixeira, E. E.; Nair, R. K. (Instituto Militar de Engenharia, Rio de Janeiro). Nucl. Technol.; 26: No. 4, 480-485(Aug 1975).

An analytical solution to the diffusion of linearly distributed impurities in a solid with an evaporating surface has been derived. The diffusion profile in the slab is obtained in the form of an infinite series of exponential and error functions. From the solution, the fractional release of the impurities is determined as a function of time. (auth)

Ceramics and Cermets

Refer also to abstracts 22435, 22829, 22894, 23614, 23619, 23626, and 23691.

22755 (AED-CONF-75-061-046) KINETIC STUDY ON THE IRRADIATION OF EXHAUST GASES. Washino, M.; Tokunaga, O.; Hashimoto, S.; Kawakami, W.; Machi, S.; Kawamura, K.; Aoki, S. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). 1975. 8p. (SM-194/706). INIS.

From international symposium on the use of high-level radiation in waste treatment-Status and prospects; Muenchen, F. R. Germany (17 Mar 1975).

7 figs.; 8 refs. With abstract. Available from ZAED.

The kinetic studies were carried out on the removal of oxides of nitrogen (NO_x) and sulfur dioxide from the combustion gas in the gas-flowing apparatus and from pure model gases in glass ampoules by electron beam irradiation. Result of the flow experiments shows that the amount of decreased NO_x is proportional to the residence time and not affected by the concentrations of both NO_x and SO_2, whereas the rate of decrease of SO_2 obeys the first order kinetics and is proportional to 1.3 power of the dose rate within the experimental conditions studied. The thermal decomposition of the product that reproduces some part of SO_2 is also suggested. SO_2 is decreased by the irradiation only when water vapor exists; suggesting the back reaction which is suppressed by the water molecules, and is expressed by a first order kinetic equation. The reaction of SO_2 removal was suppressed by the radical scavengers, e.g., ethylene or 1,3-butadiene, though it was not affected by the electron scavengers (SF_6 or N_2O). As the concentration of NO_2 increased the SO_2 removal was suppressed at the temperatures above 100°C, although NO_2 promotes the slow catalytic oxidation of SO_2 to sulfuric acid via nitrosyl sulfuric acid at lower temperatures. (auth)

22756 (BMFT-FB-K-75-04) POLYCRYSTALLINE SEMICONDUCTOR PROBES FOR MONITORING THE DENSITY DISTRIBUTION OF AN INTENSE THERMAL NEUTRON FLUX IN NUCLEAR REACTORS. Graul, J.; Mueller, R. G.; Wagner, E. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany); Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F. R. Germany)). May 1975. 135p. (In German). INIS.

The applicability of semiconductor detectors for high thermal neutron flux densities is theoretically estimated and experimentally examined. For good thermal stability and low radiation capture rate silicon carbide is used as the semiconductor material, produced in polycrystalline layers to achieve high radiation resistance. The relations between crystallinity, photoelectric sensitivity and radiation resistance are shown. The radiation resistance of polycrystalline SiC-probes is approximately 100 times greater than that of conventional single crystal radiation detectors. For thermal neutron measurement they can be used in the flux range of approximately $10^{10} \leq \phi_{n,th} \leq 5 \times 10^{13}$ ($cm^{-2}sec^{-1}$) with operation times of $1.6\ a \geq t_{b,max} \geq 30$ d, respectively. (auth)

22757 (CONF-701074-P3, pp 337-356) ASPECTS OF INFLUENCE OF STRUCTURAL CHANGES, INDUCED BY MEANS OF IRRADIATION ON THE PROPERTIES OF SINTERED MATERIALS. Lebushke, E. 1970. Translated From Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Results of neutron irradiation testing of sintered materials are reported. Materials tested include Al_2O_3 and a ferrite system $Fe_2O_4Zn-Fe_2O_4Mn-Fe_2O_4Ni-Fe_2O_4Li$. Analyses of the results are illustrated by micrographs. (JRD)

22758 (COO-2390-7) BASIC RESEARCH IN CRYSTALLINE AND NONCRYSTALLINE CERAMIC SYSTEMS. Annual Report, March 1, 1974-February 28, 1975. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 1975. Contract E(11-1)-2390. 73p. Dep. NTIS $6.75.

Research results reported are: heats of transport in hypo- and hyperstoichiometric UO_2 in thermal gradients; fabrication of transparent PLZT; creep in Al_2O_3; ambipolar diffusion and diffusional creep; diffusion-controlled final-stage sintering; sintering mechanism in Al_2O_3; internal stresses in polycrystalline Al_2O_3; x-ray study of the high-temperature alpha form of AgI single crystal; theory of effects of transmutation on radiotracer diffusion in ionic solids; ^{204}Tl diffusion in KCl at 240 to 700°C; diffusion of Ni^{2+} in MgO; defect (diffusion) equilibration kinetics in CoO; diffusional contributions to grain boundary-related damping; color boundary migration in doped Al_2O_3; defect studies in MgO and other solids; preparation of Al_2O_3-doped MgO; space charges and dielectric losses in MgO; production of thin MgO foils; precipitation in MgO; grain boundary segregation in Li-doped NiO; various research needs in ceramic science; and a test of a prototype ZrO_2-UO_2 fuel cell. (DLC)

22759 (GEMP-1003) AEC FUELS AND MATERIALS DEVELOPMENT PROGRAM, SEVENTH ANNUAL REPORT. (General Electric Co., Cincinnati, Ohio (USA). Nuclear Materials and Propulsion Operation). 29 Feb 1968. Contract AT(40-1)-2847. 145p. Dep. NTIS $10.25.

Declassified 21 Sep 1973.

Enthalpy measurements of $UO_{2.00}$ were extended to 3260°K and a heat of fusion of 18.2 kcal/mole was calculated for the discontinuity at the melting point. The solidus-liquidus separation for urania increased from near 0°C for $UO_{2.00}$ to about 150°C for $UO_{1.73}$. The hypostoichiometric phase boundary for UO_2 was measured from 1155° to 1655°C. Oxygen permeation through Mo-50Re (wt percent) is about a factor of seven slower than through Mo. Thermal gradient studies were made of UO_2 encapsulated in refractory metals. A section of the ternary diagram of U-W-O at 1300°C showed complex oxides of U and W are formed only when the O/M ratio exceeds 2.0. There is no apparent reaction between UO_2 and W up to melting point of UO_2. In the preparation of W-UO_2 cores, further improvement was achieved by sintering in wet H_2 to

reduce C content as well as maintain stoichiometry of UO_2. Analysis of time, temperature, and burnup data from dynamic in-pile tests of refractory metal clad W–UO_2 specimens suggests that temperature, burnup, creep strength of core, and creep ductility of the cladding materials are dominant factors in determining the leak-free life. Diffusion coefficients for the recoiled fission products ^{137}Cs, Zr–^{95}Nb, and ^{106}Ru in Ta at 1950°C were 10^{-10} to 10^{-11} cm^2/sec (predominantly volume diffusion) and in W–25 Re–30Mo alloy at 1650°C were approximately 10^{-12} cm^2/sec (predominantly grain boundary diffusion). Th–Zr alloys were developed which could be hydrided to the unexpectedly high N/sub H/ levels of 7.0–7.9. X-ray diffraction of these materials identified a new cubic spinel type structure (a_0 equals 9.152 A) subsequently identified as $ThZr_2H$/sub x/. Th–Ti compositions were also hydrided to extremely high-hydrogen contents, N/sub H/ 8.0–8.7 range, and contain a complex hexagonal MgZn-type structure, $ThTi_2H$/sub x/, where x approximately 6. Electrical resistivity measurements of hydrided titanium specimens irradiated to thermal neutron fluences as high as 3×10^{20} n/cm^2, indicated very little permanent radiation damage. (PMS)

22760 (KFK-2143) CARBONITRIDES IN THE SYSTEM Ta–TaC–TaN: INFLUENCE OF COMPOSITION, AGEING, AND PRECIPITATIONS ON THE HARDNESS UP TO 1300°C. Ritzhaupt-Kleissl, H. J. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Apr 1975. 136p. (In German). Dep. NTIS (US Sales Only) $10.00.

Thesis. Submitted to Karlsruhe Univ. (F. R. Germany). Fakultaet fuer Maschinenbau.

Specimens have been prepared in the binary section TaC–TaN and the carbon-rich region of the Ta–TaC–TaN system by hot pressing and subsequent homogenization. It was possible to prepare nitrogen-rich carbonitrides by homogenizing them at 1800°C under a nitrogen-pressure of 50 atm up to the composition of 70 mol% TaN/30 mol% TaC. Those carbonitrides containing less than 25 at.% nitrogen could be prepared by homogenization at 2000°C under a nitrogen-pressure of 600 torr. Subsequent aging at temperatures of 1200, 1300, and 1400°C in high vacuum as well as at 1 atm nitrogen resulted in the appearance of precipitations of ϵ-TaN, β-$Ta_2(C,N)$ and of the ζ-phase. The type, amount and shape of the precipitated phases are dependent on the aging conditions and on the composition of the specimens. Single phase specimens with compositions close to the non-metal deficient phase boundary as well as multi-phase carbonitrides with high nitrogen contents and very fine precipitates showed values of the Vickers-hardness up to 3000 kg/mm^2 at room temperature. With regard to the hot hardness up to a temperature of 1300°C specimens aged in high vacuum were superior to those which were only homogenized as well as to those aged under a nitrogen-pressure of 1 atm. On an average the best hardness-values have been found at room temperature as well as at temperatures up to 1300°C for carbonitrides consisting of 50 mol% TaC/50 mol% TaN after homogenization and subsequent aging for 40 h at 1300°C. (auth)

22761 (LA-tr-75-19) BORONIZATION OF REFRACTORY METALS. I. Process Technology. Krzyminski, H. Translated from Haerterei-Tech. Mitt.; 28: No. 2, 100-105(1973). 18p. Dep. NTIS $4.00.

A process for deposition of boride layers on refractory metals and on Zircaloy is described. The process has the effect that the oxygen adsorptively bound to the boron is driven off until there is no detectable residue. In the subsequent flooding with high-purity argon, the boron is loaded with this inert gas, which makes later reloading with atmospheric oxygen difficult. The boron which has been annealed until oxygen-free and enriched with argon can be exposed to the atmosphere several hours at room temperature without absorbing atmospheric oxygen again or any other reactive gas in a large quantity. The boronization itself proceeds in such a manner that the parts are packed into the pretreated boron; then the furnace area is evacuated and then brought to the prescribed temperature. The boronization process does not take place in a high vacuum, but under a pressure of 10^3 torr. The duration of the treatment is about 2 to 12 hours according to the thickness of the layer desired. When the prescribed duration of treatment is over, the furnace area is flooded with argon again, and the parts can be taken from the powder packing after they have cooled to room temperature. The next boronization treatment can take place without another annealing to an oxygen-free state. (auth)

22762 (LA-tr-75-20) BORONIZING OF REFRACTORY METALS. II. Constitution and Properties of Boride Layers. Kunst, H. Translated from Haerterei-Tech. Mitt.; 28: No. 2, 105-112(1973). 25p. Dep. NTIS $4.25.

Boronizing is a promising possibility for improving titanium materials that are extremely susceptible to wear. From the high degree of hardness of titanium boride materials (3500 to 4000 HV 0.025) it can be concluded that relatively thin layers suffice to solve numerous wear problems. In critical cases, however, it is possible to generate compact layers more than 50 μm thick which are free of defects, by selecting appropriate treatment conditions. The same holds for boride layers of tantalum, niobium, hafnium, and zirconium. They are not only distinguished by especially high degrees of hardness, but also by favorable corrosion properties, high electrical and thermal conductivity, and high melting points. The special properties of boride layers of refractory metals favor the assumption that the boronizing of these metals is a logical addition to the conventional surface finishing processes, and extends to the difficult border areas. (auth)

22763 (SAND-75-0347) PARAMETRIC STUDY OF THE DIAMETRAL COMPRESSION TEST FOR CERAMICS. Marion, R. H.; Johnstone, J. K. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1975. Contract AT(29-1)-789. 78p. Dep. NTIS $7.00.

The effects of sample size and padding material on the results obtained from the diametral compression test are reported. A series of uniform alumina samples ranging from 6.35 mm diameter and 3.175 mm long to 12.70 mm diameter and 12.70 mm long were tested. The padding materials tested included none, Cu, Al, Pb, IBM cards and polystyrene. The results show that the ultimate tensile strength of the samples is dependent on sample size and the padding material used. Tests were also conducted on simulated nuclear waste forms. The first direct observation of the initiation of secondary cracks in the triple-cleft fracture mode is reported. (auth)

22764 (TID-24229, pp 126-135) RETENTION OF FISSION GASES IN THE UO_2 PHASE OF Mo–UO_2 CERMETS IRRADIATED AT HIGH TEMPERATURES. Ranken, W. A.; Chaney, M. C.; Patrick, A. J. (Los Alamos Scientific Lab., NM). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Measurements have been made of the retention of xenon and krypton in the UO_2 phase of Mo–UO_2 cermets for cermet samples irradiated at average temperatures varying from 1800 to 2100°K for times ranging from 5000 to 8000 h with average fission heating rates between 220 and 280 W/cm^3. Approximate values of the effective diffusion coefficient of Kr in UO_2 have been obtained from the data. Although these values are lower than most reported in the literature they are still sufficiently high so that at a temperature of 1920°K a fractional release in excess of 80% may be expected from 20μ average diameter UO_2 particles in 10,000 h of irradiation. Hence high pressure buildup should be expected in unvented cermet fuels subjected to temperatures and fission power densities suitable for use in thermionic emitters. There is evidence that the fractional release from 125μ diameter UO_2 particles irradiated in cermet form for this same temperature and time may be only slightly less. This result appears to be due to the collection of fission gas in bubbles at the UO_2 grain boundaries and subsequent release either during cracking of these particles when the cermet is thermally cycled or when a sufficient number of bubbles has gathered at grain boundaries to form a continuous path to the particle exteriors. (auth)

22765 (TID-24229, pp 136-151) IRRADIATION BEHAVIOR OF BULK AND CERMET FUELS AT 1800°C. Melehan, J. B.; Zielenbach, W. J.; Wullaert, R. A.; Chubb, W.; Keller, D. L. (Battelle Memorial Inst., Columbus, OH). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Bulk UC, UN, tungsten–UC, tungsten–UO_2, and tungsten–UN fuels (W–26 wt% Re clad) have been irradiated in the BRR at temperatures between 1600 and 1800°C. Burnups ranged from 0.8 to 2.8×10^{20} fissions/cc during 1300 to 3900 hours. Neutron radiographs of the specimens were taken after each irradiation cycle to determine fuel length and diameter changes. Preliminary results suggest that (a) the bulk fuels and their cermet modifications swelled at about the same rates; that is, the tungsten matrix seemed to offer no additional restraint to swelling, and (b) the swelling as a function of burnup approaches a constant value which depended on the type of fuel. Bulk UN and W–UN cermets exhibited the lowest saturation level (approximately 25% volume change). A tentative explanation of this saturation

effect is based on a dynamic balance between fission gas release and sintering. (auth)

22766 (TID-24229, pp 152-157) INSTABILITY IN THE UC-TaC SYSTEM. Lowder, J. T.; Fackelmann, J. M.; Wullaert, R. A.; Speidel, E. O.; Keller, D. L. Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

$(U_{0.4}Ta_{0.6})C$ irradiation specimens demonstrated gross dimensional instability at temperatures of 1600 to 1800°C, particularly at the cooler ends of the specimens. It is believed that this instability is related to a phase transformation which has been observed in out-of-pile treatments. $(U_{0.5}Ta_{0.5})C$ alloys transform to a single phase acicular structure at temperatures of 1200 and 1500 C. The acicular phase can be removed by heat treating at 1800 to 2000°C and, therefore, appears to be the result of a eutectoid-type transformation in the uranium-tantalum-carbon system. (auth)

22767 (TID-24229, pp 158-167) CHARACTERISTICS OF URANIUM MONONITRIDE AT HIGH TEMPERATURES. Smith, R. A.; Alexander, C. A.; Speidel, E. O.; Keller, D. L. (Battelle Memorial Inst., Columbus, OH). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The relative irradiation swelling behavior of UN and UC at 1600 to 1800°C suggests that UN is weaker than UC. Possible explanations for its non-refractoriness in irradiation at these temperatures includes the experimental evidence that UN, like UO_2 is transported over a temperature gradient by vapor transport and that it will decompose very slowly into liquid uranium and vapor if this vapor (which under equilibrium conditions contains much more nitrogen than uranium) is removed under quasi-equilibrium conditions. (auth)

22768 (TID-24229, pp 178-188) URANIUM ZIRCONIUM CARBIDE FUEL FABRICATION DEVELOPMENT. Horner, M. H. (General Dynamics, San Diego, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Increased surface area exposure during machining of 90UC-10ZrC fuels required the prevention of oxidation by vacuum impregnation of the fuel with removable, protective hydrocarbons to maintain stoichiometry. Stoichiometry control during fuel body fabrication was achieved by powder blending and environmental control during powder handling. Stabilization of the carbon content of uranium-zirconium carbide fuels by presaturation with 4 wt-% tungsten was accomplished. One hundred hour compatibility tests were used to set the carbon to uranium ratio at 1.03 to 1.05. The addition of 4 wt-% tungsten allowed an increase in the sintering temperature of 90UC-10ZrC of ~150°C. (auth)

22769 (TID-24229, pp 189-196) MEASUREMENT OF BREAKDOWN VOLTAGES THROUGH CRACKS IN INSULATORS EXPOSED TO CESIUM VAPOR. Dunlay, J. B. (Thermo Electron Corp., Waltham, MA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Experimental results are presented on the measurement of breakdown or arc voltages through cracks in insulators exposed to cesium vapor. The tests were made in a cylindrical configuration with a .020 inch insulator wall thickness, an inner niobium electrode and an outer Kovar electrode. The dependence of the arc voltage on cesium vapor pressure is given together with the effect of crack width and electrode temperature. (auth)

22770 (TID-24229, pp 197-206) HIGH-TEMPERATURE CERAMIC-TO-METAL SEAL DEVELOPMENT. Chin, J.; Messick, C. W. (General Dynamics, San Diego, CA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Development of a ceramic-to-metal seal capable of operation up to 1200°C in a cesium environment is described. A new metallizing technique, based on a promising tungsten-yttria system reported by LASL, was studied. Effects of mixture age, delay time between metallizing and brazing, and high temperature outgassing were measured and found critical to the final joint strength. Seals were prepared by brazing metallized Lucalox to niobium with a 60 vanadium-40 niobium braze alloy. A complex braze thermal history was required for a high strength joint. A seal coat was developed which inhibits corrosive interaction between the braze alloy and alumina at high temperatures. With careful control of metallizing and brazing techniques, room temperature joint strengths equivalent to or better than early 700°C seals were obtained. Seals were subjected to thermal stability proof tests and remained leak tight. (auth)

22771 (UCLA-34P172-16) IRRADIATION-INDUCED PRECIPITATION IN Ni-Si ALLOYS. Barbu, A.; Ardell, A. J. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Jul 1975. Contract E(04-3)-34. 10p. Dep. NTIS $4.00.

The microstructures of Ni^+ ion-irradiated Ni-Si solid-solution alloys, containing 2, 4, 6 and 8 at. percent Si were investigated as a function of dose, dose-rate, and temperature. Results of transmission electron microscopy and other data show the precipitation of gamma' (Ni_3Si) in all samples irradiated at 500°C. Characteristics of the precipitates are described and a mechanism for their formation is suggested. (auth)

22772 DEFORMATION ZONES AROUND HELIUM PORES IN BERYLLIUM OXIDE. Khudyakov, A. V. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1264-1266(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 489-490(Dec 1974).

An investigation was made of BeO specimens irradiated with 5×10^{20} n/cm² (E ≥ 1 MeV) at ~ 100°C, after a post-pile anneal at 1000 to 1500°C. Annealing at ≥ 1300°C caused pores to appear and develop. Electron microscopic observations show fragment distortion (deformation) zones around pores which disappear on annealing; they are due to He pressure in the pores. (DLC)

22773 PREPARATION, STRUCTURE, AND PROPERTIES OF EUROPIUM RUTHENIUM HYDRIDE. Thompson, J. S.; Moyer, R. O. Jr.; Lindsay, R. (Trinity Coll., Hartford). Inorg. Chem.; 14: No. 8, 1866-1869(Aug 1975).

Eu_2RuH_6 is formed by allowing EuH_2 and Ru to react at 800° in approximately 1 atm of hydrogen. The ternary hydride is a dark red, air-stable crystalline solid which appears to be thermally stable to 900°. An analysis of x-ray powder diffraction data and density measurements suggests that the structure is consistent with the Fm3m space group wherein the ruthenium atoms assume fourfold occupancy and europium atoms assume eightfold occupancy in a fluorite type lattice. Magnetic susceptibility measurements between 77 and 296°K show that Eu_2RuH_6 obeys a Weiss-Curie law with THETA equals +43°K indicative of ferromagnetic interactions. The measured effective magnetic moment for the europium ion in Eu_2RuH_6 is 7.82 BM assuming no contributions from the ruthenium and hydrogen. This suggests the europium ions are divalent based on a comparison with a calculated value of 7.94 BM for S equals /sup ½/. Electrical resistivity measurements indicate that Eu_2RuH_6 behaves as a semiconductor. (auth)

22774 HIGH-TEMPERATURE OXIDATION BEHAVIOR OF A HfB_2 + 20 v/o SiC COMPOSITE. Hinze, J. W. (Systems Research Labs., Inc., Dayton, OH); Tripp, W. C.; Graham, H. C. J. Electrochem. Soc.; 122: No. 9, 1249-1254(Sep 1975).

The high-temperature oxidation behavior of a HfB_2 + 20 vol percent SiC composite was investigated in the temperature range 1200 to 1550°C and in oxygen partial pressures at 1400°C ranging from 2.6×10^{-9} to 3.3×10^{-1} atm. Oxidation kinetics in pure oxygen were parabolic, with the rate constants exhibiting linear Arrhenius behavior. The rate of oxygen consumption is described by k/sub p/ equals 1.62×10^7 exp (-106,000/RT) g^2-cm^{-4}-hr^{-1} in the range 1350 to 1550°C. The oxide scale formed in this range consisted of an inner HfO_2 layer in series with an outer SiO_2 layer. The oxidation rate was found to be controlled by initial short-circuit oxygen diffusion through the HfO_2, followed by volume diffusion through the SiO_2 scaling layer. Below 1350°C, rapid oxidation kinetics were observed, HfO_2 being the primary scale constituent. (auth)

22775 PHASE DIAGRAM OF Al-Ga-In-As QUATERNARY SYSTEM. Nakajima, K.; Osamura, K.; Murakami, Y. (Kyoto Univ.). J. Electrochem. Soc.; 122: No. 9, 1245-1248(Sep 1975).

The phase diagram of the Al-Ga-In-As quaternary system has been determined experimentally for several Al isoconcentration sections. The liquidus data were obtained by DTA, and the solidus data were determined from liquid epitaxial layers grown on GaAs substrates by using EPMA. The phase diagram was calculated by using a simple solution model. Most of the nine interaction pa-

rameters necessary for the present calculation are the same as those used in the corresponding binary and ternary phase diagrams, and the remaining three parameters, OMEGA/sub GaAs/ /sup l/, OMEGA/sub AlAs-InAs//sup s/, and OMEGA/sub GaAs-InAs//sup s/, were determined by fitting each calculated phase diagram to the experimental data. (auth)

22776 NOTE ON THE CRYSTAL STRUCTURE OF V_3O_5. Asbrink, S. (Univ. of Stockholm). Mater. Res. Bull.; 10: No. 8, 861-863(Aug 1975).

The observation of a great many very weak extra reflections in the x-ray diffraction spectrum of a single-crystal of V_3O_5 indicates slight deviations from the centric atomic arrangement. The indicated space groups are P2/c and Pc with a unit cell orientation different from the one originally used. A recently reported phase transition near 150°C has been confirmed by DTA measurements. (auth)

22777 ELECTRON MICROSCOPY STUDY OF ANODIC WO_3. Papadopoulos, D.; Manolikas, C.; Spyridelis, J. (Univ. of Thessaloniki, Greece). Mater. Res. Bull.; 10: No. 8, 847-852(Aug 1975).

Amorphous anodic tungsten trioxide films were studied by electron microscopy. Observations support that during electron-beam heating, various forms of nonstoichiometric tungsten oxide occur which subsequently accommodate with shear structure formation. (auth)

22778 CRYSTAL GROWTH OF NbO_2 BY CHEMICAL TRANSPORT METHOD. Kodama, H.; Goto, M. (National Inst. for Research in Inorganic Materials, Ibaraki-Ken, Japan). J. Cryst. Growth; 29: No. 2, 222-224(Jun 1975).

The preparation of large and high quality single crystals of niobium dioxide by the chemical transport method using NH_4Cl, NH_4Br, NH_4I, $NbCl_5$, or I_2 as a transporting agent is described. Transport rates of NbO_2 were measured with varying amounts of each transporting agent. The transport ability of the transporting agents decreased in the following order: NH_4Cl, NH_4Br, NH_4I, $NbCl_5$, and I_2. A study on the relation of the crystal morphology to the transporting agents has also been made. (auth)

22779 PREPARATION OF PHASE ANODIC NIOBIUM OXIDE. Bogoyavlenskij, A. F.; Lipatova, N. E. (Kazanskij Aviatsionnyj Inst. (USSR) Kafedra Obshchej Khimii). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 12, 1766-1768(1974). (In Russian).

The possibility of preparing phase enamel anode niobium oxide with a thickness of 100 μ and more was shown experimentally. The experimental data led to the recommendation of the following conditions for preparing phase anode niobium oxide: electrolyte of 10% H_2SO_4 with additions of 20 g/l of NaF, D_a = 1 amp/ϑ m^2, temperature of 20°C, and time of 1 hr. (tr-auth)

22780 MEASUREMENT AND CONTROL OF SHAPE OF FUEL PARTICLES FOR HIGH TEMPERATURE GAS-COOLED REACTORS. Lackey, W.J.; Pechin, W. H.; Sease, J. D. (Oak Ridge National Lab., TN). Am. Ceram. Soc. Bull.; 54: No. 8, 718-724(Aug 1975).

From 76th annual meeting of the American Ceramic Society; Chicago, IL (29 Apr 1974).

A rapid and meaningful technique for measuring the shape or out-of-roundness of coated fuel microspheres was developed. The index of merit is termed shape ratio and is defined as the coating thickness on one side of a particle divided by the thickness on the opposite side. More nearly spherical particles were obtained by coating in smaller charges, at higher propylene flow rates, at lower temperatures and with a porous plate rather than a single-inlet cone used as the gas distributor for the fluidized bed. (auth)

22781 Alpha-MoC SUPERCONDUCTOR FIBERS. Economy, J.; Smith, W. D. (to Corborundum Co.). US Patent 3,897,542. 29 Jul 1975. Filed date 17 Dec 1973. 8p.

Alpha-MoC, having a face-centered-cubic crystal structure, can be prepared in fiber form by subjecting a fiber having a surface comprising dimolybdenum monocarbide to an electric voltage sufficient to raise momentarily the temperature of the fiber surface to a temperature at which the alpha-MoC is the most stable thermodynamically. The fiber so produced can have a carbon core, or the fiber can be entirely converted to alpha-MoC. This fiber is useful, for example, as a superconductor material for such applications as windings on magnets. The precursor fiber having a surface comprising dimolybdenum monocarbide can be produced by reacting a carbon fiber with hydrogen and molybdenum pentachloride in a reaction furnace. (Official Gazette)

22782 PROCESS FOR CONTROLLING END-POINT DENSITY OF SINTERED URANIUM DIOXIDE NUCLEAR FUEL BODIES AND PRODUCT. Lay, K. W. (to General Electric Co.). US Patent 3,883,623. 13 May 1975. Filed date 17 Oct 1972. 10p.

A process is described for controlling the end-point density of a sintered uranium dioxide nuclear fuel body and the resulting product. Uranium dioxide powder having a size ranging up to 10 microns is mixed with a precursor to uranium dioxide, such as ammonium diuranate, having an average agglomerated particle size ranging from about 20 microns to 1 millimeter and the mixture is formed into a pressed compact or green body. The precursor to uranium dioxide has a density lower than that of the uranium dioxide powder and is used in an amount which results in discrete low density regions in the green body which range from about 5 percent to 25 percent by volume of the green body. The green body is sintered to decompose the precursor and produce a sintered body having discrete low density porous regions which reduce the end-point density of the sintered body by at least 2 percent. The sintered body has an end-point density ranging from 85 percent to 95 percent of theoretical. (Official Gazette)

22783 PREPARATION OF BERYLLIUM HYDRIDE. Lowrance, B. R. (to Ethyl Corp.). US Patent 3,885,025. 20 May 1975. Filed date 26 Feb 1962. 4p.

A process is described for the preparation of beryllium hydride which comprises pyrolyzing, while in solution in a solvent inert under the reaction conditions, with respect to reactants and products and at a temperature in the range of about 100° to about 200°C, sufficient to result in the formation of beryllium hydride, a di-t-alkyl beryllium etherate wherein each tertiary alkyl radical contains from 4 to 20 carbon atoms. The pyrolysis is carried out under an atmosphere inert under the reaction conditions, with respect to reactants and products. (Official Gazette)

22784 METHOD OF PRODUCING THERMALLY STABLE URANIUM CARBONITRIDES. Ugajin, M.; Takahashi, I. (to Japan Atomic Energy Research Inst.). US Patent 3,892,838. 1 Jul 1975. Priority date 16 Oct 1971, Japan. 6p.

A thermally stable uranium carbonitride can be produced by adding tungsten and/or molybdenum in the amount of 0.2 wt percent or more, preferably 0.5 wt percent or more, to a pure uranium carbonitride. (Official Gazette)

22785 PREPARATION OF BERYLLIUM HYDRIDE. Bergeron, C. R.; Baker, R. W. (to Ethyl Corp.). US Patent 3,883,645. 13 May 1975. Filed date 8 Dec 1967. 8p.

Beryllium hydride of high bulk density, suitable for use as a component of high-energy fuels, is prepared by the pyrolysis, in solution in an inert solvent, of a ditertiary-alkyl beryllium. An agitator introduces mechanical energy into the reaction system, during the pyrolysis, at the rate of 0.002 to 0.30 horsepower per gallon of reaction mixture. (Official Gazette)

22786 PREPARATION OF BERYLLIUM HYDRIDE. Roberts, C. B. (to Dow Chemical Co.). US Patent 3,883,646. 13 May 1975. Filed date 28 Dec 1967. 4p.

A process is described for preparing beryllium hydride by the direct reaction of beryllium borohydride and aluminum hydride trimethylamine adduct. Volatile by-products and unreacted reactants are readily removed from the product mass by sublimation and/or evaporation. (Official Gazette)

22787 ALKALI METAL POLYTUNGSTATE PHOSPHORS CONTAINING EUROPIUM. Kernohan, J. A. (to General Electric Co.). US Patent 3,881,941. 6 May 1975. Filed date 1 Oct 1973. 6p.

A particular class of alkaline metal polytungstate materials containing europium have been found to be superior in their emission response of converting UV radiation to visible light when compared with conventional phosphors. These phosphors are crystalline solids wherein the europium ion is contained in a particular polytungstate structure, and exhibit phosphorescence when excited by a source of 2537-A radiation which makes them especially useful in photodetection systems. (Official Gazette)

22788 HOT PRESSING, STRENGTH, AND FRACTURE OF CALCIUM HEXABORIDE. Dutta, S. K. (Materials and Mechanics Research Center, Watertown, MA). Am. Ceram. Soc. Bull.; 54: No. 8, 727-728(Aug 1975).

From 75th annual meeting of the American Ceramic Society; Cincinnati, OH (1 May 1973).

Fracture behavior and strength of hot-pressed CaB_6 were studied. The modulus of elasticity determined by attaching strain gages to the tensile surface of the bend bars to measure strain, was 55 +- 3 x 10^6 psi. The results are compared with values for other low density ceramic materials (B_4C, SiB_6, Be_4B, AlB_{12}) in a table. The fracture mode was observed for both modulus of rupture and impact test specimens. Predomi-

nantly transgranular fracture, associated with distinct step cleavages, is evident. Fracture origins were examined in an effort to understand the strength limiting features in hot-pressed CaB_6 specimens. Surface defects, large grain agglomerations, and isolated pore pockets were observed and varied from bar to bar; these were similar to those found in B_4C. (auth)

22789 UNIFIED MODEL OF THE INSULATOR-METAL TRANSITION IN Ti_2O_3 AND THE HIGH-TEMPERATURE TRANSITIONS IN V_2O_3. Zeiger, H. J. (Massachusetts Inst. of Tech., Lexington). Phys. Rev., B.; 11: No. 12, 5132-5144(15 Jun 1975).

A unified band-crossing model of the insulator-metal transition in Ti_2O_3 and the high-temperature transition in V_2O_3 is presented. The model is based on a Hartree-Fock free-energy calculation including electron-electron Coulomb energy, elastic energy, and band-electron entropy, and taking into account the partial overlap of e(pi) bonding and antibonding bands. Below the transition temperature, the $alpha_1$ bonding band is taken to lie below the e(pi) bonding band in Ti_2O_3, and above the Fermi level in the e(pi) bonding band in V_2O_3. This difference in ordering in the model calculation is determined largely by the difference in electron-electron Coulomb energy for Ti_2O_3 and V_2O_3. The transitions in Ti_2O_3 and V_2O_3 are ascribed to the crossing of the $alpha_1$ bonding band and the e(pi) bonding band as a function of temperature, due mainly to competition between electron-electron energy and band-electron entropy. The model calculation is applied to a description of the behavior of lattice parameters, specific heat, and magnetic susceptibility through the transition temperature in Ti_2O_3 and V_2O_3. The effect of the substitution of impurities on the nature of the transitions is discussed. The calculated properties of Ti_2O_3 are found to be at best only in qualitative agreement with experiment, and in the case of the magnetic susceptibility, in serious disagreement. It is suggested that the disagreement may be in part due to the formation of singlet excitons in Ti_2O_3. On the other hand, the model predictions are nearly quantitatively correct for many of the properties of V_2O_3. The Knight shift and nuclear-spin relaxation rate of ^{51}V and V_2O_3 are treated, and are found to agree well with experiment. (auth)

22790 METHOD FOR PRODUCING POLYCRYSTALLINE BORON NITRIDE. Alexeevskii, V. P.; Bochko, A. V.; Dzhamarov, S. S.; Karpinos, D. M.; Karyuk, G. G.; Kolomiets, I. P.; Kurdyumov, A. V.; Pivovarov, M. S.; Frantsevich, I. N.; Yarosh, V. V. US Patent 3,876,751. 8 Apr 1975. Priority date 18 Dec 1972, Ukrainian SSR. 6p.

A mixture containing less than 50 percent of graphite-like boron nitride treated by a shock wave and highly defective wurtzite-like boron nitride obtained by a shock-wave method is compressed and heated at pressure and temperature values corresponding to the region of the phase diagram for boron nitride defined by the graphite-like compact modifications of boron nitride equilibrium line and the cubic wurtzite-like boron nitride equilibrium line. The resulting crystals of boron nitride exhibit a structure of wurtzite-like boron nitride or of both wurtzite-like and cubic boron nitride. The resulting material exhibits higher plasticity as compared with polycrystalline cubic boron nitride. Tools made of this compact polycrystalline material have a longer service life under impact loads in machining hardened steel and chilled iron. (Official Gazette)

22791 METHOD FOR PRODUCING HIGHLY PURE SINTERED POLYCRYSTALLINE YTTRIUM OXIDE BODY HAVING HIGH TRANSPARENCY. Toda, G.; Matsuyama, I.; Tsukuda, Y. (to Hitachi, Ltd.). US Patent 3,873,657. 25 Mar 1975. Priority date 25 Aug 1972, Japan. 14p.

When highly pure yttrium oxide is press molded into a desired shape and then the press molded body is sintered at an elevated temperature in the presence of a beryllium compound, a sintered polycrystalline yttrium oxide body excellent in transparency is easily obtained at a comparatively low molding pressure and at a comparatively low sintering temperature. (Official Gazette)

22792 SINTERING URANIUM OXIDE IN THE REACTION PRODUCT OF HYDROGEN-CARBON DIOXIDE MIXTURES. De Hollander, W. R.; Nivas, Y. (to General Electric Co.). US Patent 3,872,022. 18 Mar 1975. Filed date 9 May 1973. 10p.

Compacted pellets of uranium oxide alone or containing one or more additives such as plutonium dioxide, gadolinium oxide, titanium dioxide, silica, and alumina are heated to 900 to 1599°C in the presence of a mixture of hydrogen and carbon dioxide, either alone or with an inert carrier gas and held at the desired temperature in this atmosphere to sinter the pellets. The sintered pellets are then cooled in an atmosphere having an oxygen partial pressure of 10^{-4} to 10^{-18} atm of oxygen such as dry hydrogen, wet hydrogen, dry carbon monoxide, wet carbon monoxide, inert gases such as nitrogen, argon, helium, and neon and mixtures of any of the foregoing including a mixture of hydrogen and carbon dioxide. The ratio of hydrogen to carbon dioxide in the gas mixture fed to the furnace is controlled to give a ratio of oxygen to uranium atoms in the sintered particles within the range of 1.98 : 1 to about 2.10 : 1. The water vapor present in the reaction products in the furnace atmosphere acts as a hydrolysis agent to aid removal of fluoride should such impurity be present in the uranium oxide. (Official Gazette)

22793 METHOD FOR PRODUCTION OF TRANSPARENT YTTRIUM OXIDE. Dutta, S. K.; Gazza, G. A. (to Secretary of the Army). US Patent 3,878,280. 15 Apr 1975. Filed date 5 May 1970. 4p.

The method comprises vacuum hot pressing the yttrium oxide (Y_2O_3) powder in a graphite die at temperatures of between 1300 to 1500°C and uniaxial pressures of between 5000 to 7000 psi, for a period of 1 to 2 hours. (Official Gazette)

22794 UH_3 CERMET. Kasberg, A. H. (to Atlantic Richfield Co.). US Patent 3,888,795. 10 Jun 1975. Filed date 3 Oct 1973. 4p.

UH_3–ductile metal cermet is used as a radiation shield in a shipping cask for spent nuclear fuel rods. The ductile metal may be Cu, Al, Pb, or Cu–Pb. (DLC)

22795 METHOD OF PRODUCING GEL SPHERES AND GELATION APPARATUS. Simpson, M. P.; Stockwell, C. L. (to United Kingdom Atomic Energy Authority). US Patent 3,886,086. 27 May 1975. Priority date 24 Jun 1971, United Kingdom of Great Britain and Northern Ireland. 4p.

In certain gelation processes the gelling of liquid droplets to produce gel spheres is achieved by allowing the droplets to fall into a liquid reagent which acts to gel the droplets. According to the present invention, a foam layer is provided above the surface of the liquid reagent to prevent the droplets from contacting the surface of the liquid reagent at a velocity sufficient to disrupt or substantially distort the droplets. Gelation apparatus for conducting the process is also disclosed, said apparatus having a column vertically divided by a baffle into a turbulent bubble region, and a substantially quiescent region through which the droplets fall after the partially gelled droplets have previously passed through the foam layer. (Official Gazette)

22796 ROLE OF DOUBLE OXYGEN BRIDGES IN FORMATION OF RADIATION PARAMAGNETIC CENTERS IN GLASS. Bilan, O. N.; Zotov, N. I.; Cherenda, N. G.; Yudin, D. M. Zh. Prikl. Spektrosk.; 22: No. 4, 713-719(Apr 1975). (In Russian).

Additional experimental data are presented on the activating effects of different types of penetrating radiation on oxide glass of the compositions $8SiO_2 \cdot 2Li_2O$; $6SiO_2 \cdot 3K_2O \cdot B_2O_3$; $5.6SiO_2 \cdot 2.9K_2O \cdot 1.5B_2O_3$; $4SiO_2 \cdot 3K_2O \cdot 3B_2O_3$ mole % and on the effect of change of the isotopic composition on the EPR spectrum. The inadequacy of existing descriptions of the results of radiation centers in irradiated glasses is noted. The role of a double oxygen bridge in the radiation processes is explained, and a new interpretation of the nature of paramagnetic centers is presented. (tr-auth)

22797 MAGNETIC PROPERTIES AND THE METAL–INSULATOR TRANSITIONS IN V_2O_3. Capellmann, H. (Technische Hochschule, Aachen). Phys. Status Solidi B.; 70: No. 1, 63-69(1 Jul 1975).

Based on a formal theory of correlations in degenerate bands a qualitative description of the physical nature of the transitions in V_2O_3 is given. It is argued that the low temperature insulating phase is a magnetic insulator, the intermediate metallic phase is described by the correlated metal, and the high temperature insulating phase is an excitonic insulator. The driving force for the transitions is the interband mixing term contained explicitly in the Hamiltonian. (auth)

22798 REACTIONS OF Ti, Zr, AND Hf WITH OXYGEN. Hoerz, G. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Metall. Ital.; 67: No. 3, 126-132(Mar 1975). (In Italian).

A survey is given on recent investigations concerning the reactions of the IVa-metals titanium, zirconium, and hafnium with oxygen. Results on the electrical resistivity of β-Ti-O, β-Zr-O, and α-Hf-O solid solutions as a function of temperature and oxygen concentration are reported. The kinetics of oxygen absorption by β-titanium, β-zirconium, and α-hafnium at temperatures above 1100°C and at oxygen pressures below about 5×10^{-4} torr are examined. The results obtained for IVa metals are discussed and compared with the corresponding data for the Va metals vanadium, niobium, and tantalum. (auth)

22799 PRODUCTION OF SPHERIC GRANULES OF ZrC–W CERMET BY ROTATION METHOD. Kalinina, N. G.; Mints, E. I.; Neshpor, V. S. Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 17-21(Apr 1975). (In Russian).

ZrC–W cermet powders with an increased specific surface form smaller spheric grains during rotation granulation, the parameters of the process being the same. The average size of the

granules decreases approximately linearly with the content of moistening liquid (dibutyl phthalate) in the powder from 0.1 to 0.6 wt %; with a further rise in the dibutyl phthalate content from 0.6 to 0.9 wt % the granule size increases somewhat if the time of granulation does not exceed 2 h. The granule size increases with the duration of the granulation time. The magnitude of the powder loading within the limits of 40–200 g has no practical effect on the granule growth rate. The density of the sintered granule rises with a decrease in their size. Bulk density, mass of shaking down and fluidity of the sintered granules do not depend on their size (for 300–80 μm fractions). (auth)

22800 NEUTRON RADIOGRAPHY INSTALLATION FOR THE CONTROL OF Pu-ENRICHED FUEL PINS. Desprez, G. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Nostin, N. (Soceite Belge pour l'Industrie Nucleaire, Brussels). pp 225 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French).

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The neutron radiography installation (source, collimator, dysprosium convector, films, rod container) is described together with the procedure used. The results obtained on Pu fuel for thermal reactor are given (presence of foreign materials, size of Pu grains, density variations). (FR)

22801 IMPACT OF URANATE CALCINATION REGIME AND URANIUM DIOXIDE SINTERING SCHEDULES ON THE PREPARATION OF PELLETS OF CONTROLLED DENSITIES. Farah, M. Y.; Elfekey, S. A.; Hammad, F. H.; Bishay, A. F. (Atomic Energy Establishment, Cairo (Egypt)). pp 226-227 of La maturite de l'energie nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The correlation between uranate calcination or reduction and the densities of products is examined in order to propose a new method of preparing, on request, pellets using static beds, no grinding or binding material addition and low-temperature hydrogen sintering without special presintering in controlled atmosphere. (FR)

22802 EFFECT OF THE GRAIN SIZE ON THE CONDUCTIVITY OF HIGH-PURITY PORE-FREE CERAMICS Y_2O_3+ZrO_2. Ioffe, A. I.; Inozemtsev, M. V.; Lipilin, A. S.; Perfilev, M. V.; Karpachov, S. V. (Ural Scientific Center, Sverdlovsk, USSR). Phys. Status Solidi A.; 30: No. 1, 87-95(16 Jul 1975).

Measurements of the electrolyte overall resistance, as well as the grain volume and boundary resistances comprising it, reveal that the grain volume resistance remains constant while that of grain boundaries and accordingly of the electrolyte decreases with the increase of the average grain size and sintering temperature. The activation energy for conductivity of the grain boundaries is higher than that of the grain volume due to which at high temperatures the electrolyte conductivity is mainly determined by the grain conductivity, while at low temperatures it is the boundary conductivity that matters. (auth)

22803 NIOBIUM–HYDROGEN SYSTEM: AN ELECTRON MICROSCOPE STUDY. II. Low Temperature Structures. Schober, T. (Kernforschungsanlage, Juelich, Ger.). Phys. Status Solidi A.; 30: No. 1, 107-116(16 Jul 1975).

The structure and morphology of low temperature hydride phases are investigated. Quenching of dilute alloys produces small hydride particles which emitted interstitial dislocation loops into the matrix. Irreversible dislocation "skeletons" were generated when such hydride precipitates were thermally dissolved. Three ordered solutions were observed: the β-phase above −45°C, the ζ-phase from −45 to −65°C, and the ϵ-phase below −65°C. The reciprocal lattices of ζ and ϵ were determined. The ϵ-phase is identical with the hydride Nb_4D_3 found by Somenkov et al. ζ and ϵ are orthorhombic with the same lattice parameters as β. (auth)

22804 SEMICONDUCTOR-METAL TRANSITION IN $VO_{0.996}Al_{0.004}O_{2+x}$. Brueckner, W. (Central Inst. for Solid State Physics and Materials Research, Dresden). Phys. Status Solidi A.; 30: No. 1, K29-K31(16 Jul 1975).

Results of magnetic measurements on VO_{2+x} with Al impurities are presented. It was found that in $VO_{0.996}Al_{0.004}O_{2+x}$ the kind of phase in the semiconductor state of VO_2 does not only depend on the metallic doping, but on the oxygen content, too. Oxygen deficiency can prevent the formation of distorted rutile phases. Hence, the structure distortion in VO_2 ($T < T_t$) depends on the number of vanadium interstitials through nonstoichiometry, and on the substituted ions through doping elements. Possibly the ion size relations, but more probably the electronic properties of the defects, determine the structure. (auth)

22805 SWELLING OF URANIUM SILICIDE FUEL DURING POSTIRRADIATION HEATING. Matthews, R. B.; Swanson, M. L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Nucl. Technol.; 26: No. 3, 278-286(Jul 1975).

Postirradiation heating tests have demonstrated that irradiated uranium silicide fuel undergoes rapid and gross swelling at temperatures above 900°C. At these temperatures the fission-gas pressure in irradiation-induced pores will exceed the self-restraint of the fuel, and the pores will swell to satisfy the temperature and pressure conditions. The amount of swelling increases with both temperature and burnup, but external pressure helps restrain swelling. Fast heating rates increase the amount of swelling. (auth)

22806 ION IMPLANTATION AS DOPING PROCEDURE IN SEMICONDUCTOR TECHNOLOGY. Eckstein, D. (Valvo G.m.b.H., Hamburg). Funk-Tech.; No. 15, 525-528(1974). (In German).

Following a brief survey on the development of the doping procedure in the semiconductor technology, the production of high-energy ion beams and the procedures in the semiconductor during ion implantation are described and examples of application for the production of electronic components and radiation detectors are given. (GE)

22807 CAUSE OF LOSS OF HYDROGEN-OVERVOLTAGE ON GRAPHITE ELECTRODES USED FOR ANODIC STRIPPING VOLTAMMETRY. Clem, R. G. (Univ. of California, Berkeley). Anal. Chem.; 47: No. 11, 1778-1784(Sep 1975).

Work with neutron-damaged graphites shows conclusively that structure is not the cause of anodic stripping voltammetry (ASV) electrode failure. Mercuric and especially trace silver-ion strongly catalyze the oxidation of the graphite electrode surface with the result that graphite oxides are formed. Formation of carboxyl groups are the likely cause of loss of hydrogen overvoltage. Electrode behavior after treatment with vacuum ultraviolet light, diazomethane, lithium aluminum hydride, dimethylmercury, various amines, and propylene oxide is described. (auth)

22808 RAMAN SPECTRA OF VITREOUS MATERIALS OF THE $LiO–B_2O_3$ SYSTEM. Bertoluzza, A.; Fagnano, C.; Monti, P. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.; 55: No. 5, 506-514(Nov 1973). (In Italian).

Raman spectra of materials of binary molar composition B_2O_3/Li_2O variable between 9 and I in the glassy system $B_2O_3–Li_2O$ are discussed relative to the boric anomaly phenomenon presented by these glasses and relative to the measurements of diamagnetic anisotropy and nuclear magnetic resonance. In analogy to these latest measures the presence of structural centers consisting of boroxol groups $B_3O_3(O)_3$ is made evident in the glasses richest in B_2O_3 up to the composition $3B_2O_3 \cdot Li_2O$. Moreover it is possible to reveal the diminution of boroxol groups number in this interval of compositions when the Li_2O percentage rises. The presence of these centers is deduced from Raman spectra, particularly from the typical band at 808 cm^{-1}. The addition of Li_2O to B_2O_3 up to the glass of composition B_2O_3/Li_2O = 3 allows the gradual boron transformation from a trigonal to a tetrahedral coordination, according to the measures of diamagnetic anisotropy and nuclear magnetic resonance. Only by successive addition of Li_2O is a demolition of the σ-bonds structure in the glassy material and the reformation of boron trigonal centers also possible. The probable mechanism of this reformation is assigned. Particularly, the Raman spectrum of the glass of composition B_2O_3/Li_2O = 1 agrees with that of melted $LiKO \cdot B_2O_3$ and is analogously interpretable on the basis of the presence, in the material, of boron trigonal atoms. (auth)

22809 METHOD OF PRODUCTION OF COMPOSITE FUEL BODIES FOR BLOCK-SHAPED HIGH-TEMPERATURE FUEL ELEMENTS. Hrovat, M.; Rachor, L. (to Hochtemperatur-Reaktor-Brennelement GmbH). German(FRG) Patent 2,338,155/S/. 20 Feb 1975. 9p. (In German)

A method of production of composite fuel bodies is claimed. These fuel bodies consist of an isotropic, radiation resistant graphite matrix with good thermal conductivity with immersed coated fuel or breeder particles. Covering of the coated particles with a pressure mixture of graphite powder and thermoplastic binder makes them suitable for use in high-temperature reactors. After covering only the surface of the particles is treated with hardener and lubricant. They are then compressed and hardened in a cavity at a constant temperature of 150°C and are expelled as finished composite bodies. With this method, final hardening is carried out after compression, so that the composite bodies can be produced at low pressure. (GE)

Metals and Alloys

22810 (BNWL-SA-5440) CHIMERA OF NEW NUCLEAR MATERIALS. Bush, S. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. 67p. (CONF-750644-4). Dep. NTIS $6.50.

From annual conference of the American Society for Engineering Education; Ft. Collins, Colorado, USA (16 Jun 1975).

The current and future needs in materials for light water reactors and liquid metal fast breeder reactors are reviewed. Information and discussions are included on boiling water reactors, pressurized water reactors, liquid metal fast breeder reactors, corrosion of piping systems and steam generators, ferritic steels, stainless steels, Inconel 600, pressure vessels, and radiation damage. (JRD)

22811 (LA-DC-10923) SAFETY PROBLEMS WITH ABANDONED EXPLOSIVE FACILITIES. Courtright, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1969. Contract W-7405-eng-36. 45p. (CONF-690993-1). Dep. NTIS $5.25.

From 11th annual meeting of armed services explosives safety board; Memphis, Tennessee, USA (9 Sep 1969).

Procedures were developed for the safe removal of explosive and radioactive contaminated materials structures and drains from abandoned sites, including explosives processing and service buildings with a goal to return the entire area to its natural state and to permit public access. The safety problems encountered in the cleanup and their solutions are applicable to modification and maintenance work in operating explosive facilities. (PCS)

22812 LIESEGANG BANDS IN INTERNALLY OXIDIZED AgCd-BASED TERNARY ALLOYS. Van Rooijen, V. A. (Universiteitscomplex Paddepoel, Groningen, Netherlands); Van Royen, E. W.; Vrijen, J.; Radelaar, S. Acta Metall.; 23: No. 8, 987-995 (Aug 1975).

The origin of the occurrence of Liesegang band formation (periodic precipitation) during internal oxidation of AgCd alloys containing concentrations of Be, Mg, Al, or Y were investigated both experimentally and theoretically. A simple model of internal oxidation of ternary alloys is presented. The theory predicts band spacing as a function of temperature, Cd concentration, and concentration of the third element in good agreement with experimental results. (auth)

22813 PLUTONIUM-DOKUMENTATION. Transplutonium Elemente. Band 9, Heft 1-3. 1. Vierteljahresregister 1975. (Plutonium-Documentation. Transplutonium Elements. Volume 9, No. 1-3. First Quarterly Index 1975). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung, m.b.H. (1975). 81p. (In German and English).

22814 PLUTONIUM-DOKUMENTATION. Transplutonium Elemente. Referate-Zeitschrift. Juni 1975. Band, 9, Heft 6. 275 Referate (Register-Nr. 1851-2376); 65 Referate (Register-Nr. 401T-465T). (Plutonium Documentation. Transplutonium Elements. Abstract Journal. June 1975. Volume 9, No. 6. 275 Abstracts (Register No. 1851-2376); 65 Abstracts (Register No. 401T-465T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung m.b.H. (Jun 1975). 153p. (In German and English).

Corrosion and Erosion

Refer also to abstracts 21922, 22761, 22762, and 22798.

22815 (ARH-ST-111) COMPILATION OF HANFORD CORROSION STUDIES. Lini, D. C. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jul 1975. Contract AT(45-1)-2130. 36p. Dep. NTIS $3.75.

Experimental Hanford corrosion studies are reviewed with the intent of identifying the types and rates of corrosion encountered, surveying the experimental techniques used to gather corrosion data, and indicating how these data contribute to tank failure predictions. The experimental studies in this document can be divided into the following areas: general and pitting corrosion, stress corrosion cracking, corrosivity of solidified high-level waste, and cathodic protection. (auth)

22816 (BM-RI-7986) ELECTROCHEMICAL ANODIC REACTION RATE OF VANADIUM METAL WITH MOLTEN VCl_2-VCl_3-NaCl MIXTURES. Raddatz, A. E.; MacDonald, D. J. (Bureau of Mines, Reno, Nev. (USA). Reno Metallurgy Research Center). 1974. 12p. Dep. NTIS $4.00.

The electrochemical rate of anodic dissolution of vanadium metal in a VCl_2-VCl_3-NaCl electrolyte at 860°C was determined to elucidate the reaction mechanism. Rate measurements were carried out with the help of specially designed equipment capable of continuously recording the weight loss experienced by a cylindrical vanadium anode immersed in the molten salt electrolyte while a constant current is maintained through it. The rate is expressed as a function of current density and VCl_3 concentration, and the reaction is interpreted in terms of an adsorption mechanism. Multiple regression analysis of the data gave the following rate equation: Rate x 10^4 ($g \cdot cm^{-2} \cdot sec^{-1}$) equals -0.38 + 2.64 current density (amp · cm^{-2}) + 0.69 log/sub e/ (mole-percent VCl_3). (auth)

22817 (CONF-701074-P3, pp 357-374) DEVELOPMENT AND INVESTIGATION OF PERLITIC STEEL FOR STEAM GENERATORS OF ATOMIC POWER PLANTS WITH SODIUM COOLANT. Kapirin, G. I.; Gorinin, I. V.; Gribov, N. N.; Belandin, U. F.; Shurakov, S. S.; Trapeznikov, U. M. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Decarbonization of perlitic heat-resistant steels in sodium was investigated. For determination of resistance of steels, a thermodynamic calculation was proposed for decarbonization, which was substantiated during experiments using sodium. The redistribution of carbon was investigated by the labeled atom method. The intensity and degree of decarbonization of steels IX2M and IX2MΦΣ were studied as a function of time. As a result of investigations of corrosion by sodium, the technological effectiveness, mechanical properties, and temperature stability in steam generators with sodium coolant, perlitic steels IX2M for use up to 450 and IX2M ΦΣ for use up to 550°C were selected. (auth)

22818 (DP-MS-75-16) ROLE OF TEST TECHNIQUE IN EVALUATING HYDROGEN EMBRITTLEMENT MECHANISMS. Louthan, M. R. Jr.; McNitt, R. P. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab; Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 1975. Contract AT(07-2)-1. 11p. (CONF-750925-3). Dep. NTIS $4.00.

From conference on effects of hydrogen on behavior of materials; Jackson, Wyoming, USA (7 Sep 1975).

Evaluation of the proposed embrittlement mechanisms indicates that the particular test techniques utilized have had major influences on the development of mechanistic proposals. The relationship between test techniques and proposed embrittlement mechanisms is discussed, and a group of observations with which any universal mechanism must be compatible is presented. (LK)

22819 NEW HIGH-CHROMIUM FERRITIC STAINLESS STEEL. Pinnow, K. E.; Bressanelli, J. P.; Moskowitz, A. Met. Eng. Q.; 15: No. 3, 32-41(Aug 1975).

Crucible 26-1 (^{26}Cr, 0.5 max Ni, 1 Mo) has been developed to provide an outstanding combination of resistance to chloride stress corrosion cracking, resistance to general, pitting, and crevice corrosion, and good fabricability. Available in sheet, strip, tubing, and welding wire, the alloy is finding substantial application in replacing brass and cupronickel, corrosion-resistant high-nickel alloys, and other materials in the food processing, power, chemical, petrochemical, marine, and pulp and paper industries. Its corrosion is compared with other stainless steels, including Type 316. (auth)

22820 WELD-STABLE NICKEL-MOLYBDENUM FOR MINERAL ACID APPLICATIONS. Hamilton, J. (Langley Alloys Ltd., Slough, Eng.). Process Eng.; 65-66(Jun 1975).

Hastelloy alloy B is a nickel-molybdenum alloy with excellent resistance to corrosive effects of hydrochloric acid, possessing high temperature properties being usable in oxidizing atmospheres, but not in oxidizing solutions. The susceptibility of the alloy to selective corrosion in the heat affected zone of welds can be overcome by a solution heat treatment at 1,100 C after welding, but this procedure is expensive and impractical and can lead to distortion in the case of large and complex fabrications. The causes of this problem are examined for Hastelloy alloy C and austenitic stainless steels. From this experience, an improved version of Hastelloy B is now in the final stage of production scale-up. By reducing carbon levels and by the adoption of improved melting and manufacturing techniques, Hastelloy Developmental alloy B-2 has been introduced. A detailed evaluation of the fabrication characteristics and corrosion resistance has been made of the new alloy. In addition to being resistant to hydrochloric acid at all concentrations and temperatures and to sulfuric acid, the new alloy resists hydrogen chloride gas, acetic and formic acids, and many other common corrosives. It is not resistant to nitric acid and wet chlorine and is not recommended for use in direct contact with iron or copper in chloride-containing environments. (MCW)

22821 EFFECT OF COBALT AND RARE-EARTH METALS (YTTRIUM, LANTHANUM, AND CERIUM) ON THE KINETICS AND MECHANISM OF THE OXIDATION OF NICKEL–CHROMIUM ALLOYS. Lazarev, E. M.; Abramova, N. B.; Ignatov, D. V. Russ. J. Phys. Chem.; 48: No. 11, 1629-1632(Nov 1974).

Translated from Zh. Fiz. Khim.; 48: No. 11, 2769-2773(Nov 1974).

A structural and kinetic investigation was made of the oxidation of Ni–10Cr–15Co [mass %] alloys containing 0.2% of a rare-earth metal—yttrium, lanthanum, or cerium—at 1000 to 1200°C for 100 to 1500 h. The oxidation resistance of the alloys is impaired by cobalt, but enhanced by the rare earth metals. Alloying with the latter lowers the rate of oxidation of the Ni–Cr–Co alloy by factors >10 at 1000 to 1100° and 3 to 4 at 1200°C owing to the formation of finely dispersed deposits of $YCrO_3$ at the grain boundaries. (auth)

22822 CORROSION OF CONDENSER TUBE ALLOYS IN SULFIDE CONTAMINATED BRINE. Bates, J. F.; Popplewell, J. M. (Olin Metals Research Labs., New Haven). Corrosion; 31: No. 8, 269-275(Aug 1975).

Increasing sulfide pollution of harbors and river estuaries has markedly increased corrosion of surface condenser alloys using once through cooling water. A laboratory study was conducted of several condenser tube alloys in flowing buffered sodium chloride solution, contaminated periodically with sulfide. The results showed that alternate treatment with sulfide and air was much more aggressive than air alone or sulfide alone. Corrosion performance of the alloys is compared. (auth)

22823 CURRENT DENSITY CONTOUR MAPS: EXPERIMENTAL DETERMINATION AND ANALYSIS. Laliberte, L. H.; Mueller, W. A. (Pulp and Paper Research Inst. of Canada, Quebec). Corrosion; 31: No. 8, 286-296(Aug 1975).

The development of a new technique for crevice-free mounting of stainless steel specimens has permitted the investigation of the pitting corrosion of 317L and 2RN65 (sandvik) stainless steels in solutions containing chloride ion. Current Density Contour Maps (CDC Maps) have been constructed from potentiodynamic polarization curves, by plotting iso-current density contours in the potential-pH plane. The results illustrate how the terms (delta log i/delta pH)/sub E/, (delta log i/deltaE)/sub pH/, and (delta pH/deltaE)/sub i/, determined from CDC Maps, can be used to predict susceptibility to pitting and crevice corrosion of specific alloy-electrolyte combinations. Evidence is also presented for two types of pitting sites and/or two pitting mechanisms operating in different potential regions. Pitting at the primary sites was found to depend on the pH and the chloride concentration and to be related to the corrosion history of the surface. Attack at the secondary sites occurred at higher potentials and depended only on the chloride ion concentration. The repassivation potential of the stainless steels tested depended primarily on the bulk chloride concentration, and less on the alloy composition or the pH of the bulk electrolyte. (auth)

22824 LABORATORY STUDIES OF GALVANIC CORROSION. I. Two-Metal Couples. Mansfeld, F.; Kenkel, J. V. (Rockwell International, Thousand Oaks, CA). Corrosion; 31: No. 8, 298-302(Aug 1975).

Galvanic interaction of stainless steel 304L, Ni 270, Cu, Ti–6Al–4V, Sn, 4130 steel, Cd, and Zn has been studied in 3.5 percent NaCl using galvanic current and weight loss measurements in 24-hour tests. Galvanic couples of 4130 steel and one of the Al alloys 1100, 2024, 2219, 6061, and 7075 have also been evaluated in tap water and distilled water. Galvanic current data can be used to assess both the effect of different dissimilar cathode materials as well as the relative susceptibility to galvanic corrosion of anode materials. For 3.5 percent NaCl, it has been found that the effect of the cathode material decreases in the order Cu greater than Ni greater than stainless steel greater than Ti–6Al–4V, while the relative susceptibility of anode materials decreases in the order Sn greater than Zn greater than 4130 steel greater than Cd. An analysis of data in various electrolytes shows that coupling of 4130 steel to Al alloys leads to cathodic protection of the steel in 3.5 percent NaCl, but to accelerated corrosion in tap water and distilled water. (auth)

22825 COMPARISON OF ISOTHERMAL AND CYCLIC OXIDATION BEHAVIOR OF TWENTY-FIVE COMMERCIAL SHEET ALLOYS AT 1150°C. Barrett, C. A.; Lowell, C. E. (Lewis Research Center, Cleveland). Oxid. Met.; 9: No. 4, 307-355(Aug 1975).

Twenty-five commercial nickel-, iron-, and cobalt-base sheet alloys incorporating chromium or chromium and aluminum additions for oxidation resistance were tested at 1150°C in air for 100 h in both isothermal and 1-h cyclic furnace exposures. The alloys were evaluated by sample specific weight change, by type of scale formed, by amount and type of spall, and by sample thickness change and microstructure. In isothermal steady-state oxidation, four types of controlling oxides were observed depending on alloy composition: NiO, Cr_2O_3–chromite spinel, ThO_2-blocked Cr_2O_3, and alphaAl_2O_3–aluminate spinel. The latter three types are considered protective. In the Cr_2O_3-forming alloys, however, scale vaporization is a critical factor in determining the parabolic scaling rate based on paralinear oxidation. In cyclic oxidation the alloys which form Cr_2O_3–chromite spinel scales were degraded severely when sufficient chromite spinel developed to trigger spalling. The cyclic behavior of the other three types of alloys does not differ greatly from their isothermal behavior. A tentative mass-balance approach to scale buildup, scale vaporization, and scale spalling was used to calculate the critical oxidation parameter--the effective metal thickness change. In general, this change agrees with the measured change to within a factor of 3 if a correction is made for grain boundary oxidation. The calculated thickness change parameter was used to rate the oxidation resistance of the various alloys under isothermal or cyclic conditions. The best alloys in cyclic furnace oxidation tests were either alphaAl_2O_3–aluminate spinel formers or Cr_2O_3 formers with ThO_2 blockage. (15 fig, 8 tables) (auth)

22826 OXIDATION BEHAVIOR OF A Zr–0.5Y ALLOY. Nasrallah, M. M. (Cairo Univ.); Douglass, D. L. Oxid. Met.; 9: No. 4, 357-365(Aug 1975).

A Zr–0.5Y alloy was found to oxidize about 6 times faster than pure zirconium at 400 to 565°C. The activation energies were nearly identical (approximately 32 kcal/mole) and correspond to grain boundary diffusion of oxygen through the scale. The higher oxidation rate of the alloy was attributed to a higher anion vacancy concentration and the assumption that diffusion sites in the lattice and boundaries were in local equilibrium. Measurements on yttria-doped zirconia showed that ionic conductivity was increased markedly by yttrium and extended over a wide range of oxygen pressure. The defect structure of the doped oxide was changed to one of oxygen vacancies, even at the high end of the oxygen pressure range, 10^{-8} to 0.2 atm, over which pure zirconia contains oxygen interstitials. The doped oxide was found to be extrinsic over the entire range of oxygen pressure, and, although ionic conductivity predominated, electronic conductivity was still appreciable. The electronic conductivity, however, was still sufficiently high so that electron transport was not rate-controlling in the predominantly ionic-conducting scale. (auth)

Preparation and Fabrication

Refer also to abstracts 22433, 22770, and 22799.

22827 (BM-RI-7986) ELECTROCHEMICAL ANODIC REACTION RATE OF VANADIUM METAL WITH MOLTEN VCl_2-VCl_3-NaCl MIXTURES. Raddatz, A. E.; MacDonald, D. J. (Bureau of Mines, Reno, Nev. (USA). Reno Metallurgy Research Center). 1974. 9p. Bureau of Mines, Washington, DC.

The electrochemical rate of anodic dissolution of vanadium metal in a VCl_2-VCl_3-NaCl electrolyte at 860°C was determined for the purpose of elucidating the reaction mechanism. Rate measurements were carried out with the help of specially designed equipment capable of continuously recording the weight loss experienced by a cylindrical vanadium anode immersed in the molten salt electrolyte while a constant current is maintained through it. The rate is expressed as a function of current density and VCl_2 concentration, and the reaction is interpreted in terms of an adsorption mechanism. Multiple regression analysis of the data gave the following rate equation: Rate x 10^4 ($g \cdot cm^{-2} \cdot s^{-1}$) equals $-0.38 + 2.64$ current density ($A \cdot cm^{-2}$) + 0.69 log/sub e/ (mole percent VCl_2). (auth)

22828 (CONF-701074–P3, pp 313-336) OBTAINING OF ZIRCONIUM BY MEANS OF ELECTROLYSIS OF MOLTEN SALTS. Mindru, G. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Production of Zr by electrolysis of K_2ZrF_6–NaCl electrolyte was investigated. Optimal working parameters were determined, keeping in view the purity of the product and the efficiency of the equipment. The effect of the repeated use of electrolyte on the coefficient of output of metal was investigated. Repeated use of the electrolyte is advantageous only when the coefficient of output of metal, obtained after the first cycle of electrolysis, is

below 80%. A partial separation of zirconium from hafnium was accomplished by the electrolysis. The content of Hf in the fluorozirconate after electrolysis is 0.7 to 0.01% which represents 97% separation. (auth)

22829 (SLA-73-0957) TECHNIQUE FOR SEALING CORNING CODE 1720 GLASS TO MOLYBDENUM. Eagan, R. J. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Nov 1973. Contract AT(29-1)-789. 24p. Dep. NTIS $4.25.

A technique of sealing Corning Code 1720 glass to molybdenum in an inert atmosphere was developed, which eliminates the formation of volatile MoO_3 during seal fabrication. The method consists of pressing the molten glass into the desired shape using graphite molds and the metal piece to be sealed. To obtain stronger seals with Code 1720 glass, minor constituents were added to the glass to obtain non-volatile oxides of the molybdenum during seal formation. (auth)

22830 (UCRL-Trans-10884) REFRACTORY METAL POWDER TREATED WITH EXPLOSION PRESSURE. Pruemmer, R. Translated from Maschinenmarkt.; 80: No. 99, (10 Dec 1974. 15p. Dep. NTIS $4.00.

In explosive compaction, shock-wave loading of metal powder activates it for the subsequent sintering process. Because of the high density of the pressed specimen produced, subsequent sintering can be accomplished practically without shrinkage. Cylindrical parts, pipes, and hollow cones of refractory metal have already been manufactured. The maximum densities of the pressed specimens are not attained due to the high pressure alone during explosive compaction. Although the pressure acts for only a short time, the material velocities which occur favor interlocking of the powder particles. (auth)

22831 (Y-DA-6300) ELECTROSLAG REMELTING OF A URANIUM ALLOY. Cadden, J. L.; Lewis, P. S. Jr. (Oak Ridge Y-12 Plant, Tenn. (USA)). 12 Jun 1975. Contract W-7405-eng-26. 28p. (CONF-750670-1). Dep. NTIS $4.50.

From vacuum metallurgy conference; Columbus, Ohio, USA (23 Jun 1975).

A method for electroslag remelting (ESR) of a uranium alloy was developed which reduced the oxygen content from 200 to 300 ppM to less than 50 ppM. Slag compositions included acid grade CaF_2, reagent grade CaF_2, $CaF_2 \cdot Ca$ and $CaF_2 \cdot MgF_2$ in ESR melting a uranium-7.5 wt percent niobium-2.5 wt percent zirconium alloy. Equipment and techniques were developed for dry slag starts and dry slag additions during melting. The effects of straight polarity versus reverse polarity were examined as well as the effectiveness of stirring. Microexamination of the slag after melting was made and the chemical composition was determined. The uranium alloy was also examined chemically and microscopically for the size and distribution of inclusions. A comparison of alloy segregation was made between vacuum arc remelted material by radiography. (auth)

22832 MODELLING OF REARRANGEMENT PROCESSES IN LIQUID PHASE SINTERING. Huppmann, W. J.; Riegger, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Acta Metall.; 23: No. 8, 965-971(Aug 1975).

Tungsten spheres of uniform size were coated with copper. Planar arrays of these particles were presintered and then heated above the melting point of copper for four minutes. By direct comparison of the presintered and the liquid phase sintered condition the movements of individual particles could be measured as a function of the amount of liquid, wetting angle, and packing density. Melt bridge formation between adjacent particles in densely packed arrays can be understood on the basis of calculations in which the force acting between two particles is computed as a function of the interparticle spacing. The shrinkage by rearrangement processes in randomly packed arrays is also a function of the capillary forces acting in these melt bridges, however, at the same time strong evidence is presented for intrinsic forces acting in such a way as to impede densification in an array of powder particles. (9 fig) (auth)

22833 COATED AIR-STABLE COBALT-RARE EARTH ALLOY PARTICLES AND METHOD. Smeggil, J. C.; Charles, R. J. (to General Electric Co.). US Patent 3,892,601. 1 Jul 1975. Filed date 14 Mar 1974. 12p.

A process is described for producing novel air-stable coated particles of a magnetic transition metal-rare earth alloys. An organometallic compound which decomposes at a temperature below 500°C is heated to produce a metal vapor which is contacted with particles of a transition metal-rare earth alloy to deposit a metal coating on the particles. (Official Gazette)

22834 HEAT TREATMENT OF NICKEL ALLOYS. Smith, D. F. Jr.; Clatworthy, E. F. (to International Nickel Co.). US Patent 3,871,928. 18 Mar 1975. Filed date 13 Aug 1973. 10p.

A heat treating process is described that can be used to produce desired combinations of strength, ductility, and fabricability characteristics in heat resistant age-hardenable alloys having precipitation-hardening amounts of niobium, titanium, and/or tantalum in a nickel-containing matrix. (Official Gazette)

22835 PROCESS FOR ELECTROFORMING NICKEL CONTAINING DISPERSED THORIUM OXIDE PARTICLES THEREIN. Malone, G. A. (to Textron Inc.). US Patent 3,883,402. 13 May 1975. Filed date 10 May 1974. 14p.

Nickel electroforming is effected by passing a direct current through a bath containing a dissolved nickel salt or a mixture of such salts, such as those present in sulfamate or Watts baths, and finely divided sol-derived thorium oxide particles of 75 to 300 angstroms, preferably 100 to 200 angstroms diameters therein, at a pH in the range of 0.4 to 1.9, preferably 0.8 to 1.3. The nickel so deposited, as on a pre-shaped stainless steel cathode, may be produced in desired shape and may be removed from the cathode and upon removal, without additional working, possesses desirable engineering properties at elevated temperatures, e.g., 1,500 to 2,200°F. Although the material produced is of improved high temperature stability, hardness, and ductility, compared with nickel alone, it is still ductile at room temperature and has properties equivalent or superior to nickel at room temperatures up to 1,500°F. Further improvements in mechanical properties of the material may be obtained by working. Also disclosed are electrodeposition baths, methods for their manufacture, and products resulting from the electrodeposition process. (Official Gazette)

22836 Nb JOINED TO ALUMINA WITH Ni-Ti EUTECTIC SEAL. Purdy, D. L.; Williams, J. F. (to Arco Nuclear Co.). US Patent 3,897,223. 29 Jul 1975. Filed date 17 Oct 1974. 6p.

A method is described for joining members of copper and tungsten and members of copper and corrosion and/or temperature-resistant nickel-base alloys in the practice of which a mass of titanium is interposed between the members and the joint is heated to produce a eutectic of copper and titanium and then permitted to solidify. A like method is described for joining members of niobium and aluminium oxide in which a mass of nickel and titanium or of titanium alone are interposed between the members. Brazed assemblies are produced by the methods. A high-temperature resistant vacuum seal of niobium and aluminium oxide is formed. (auth)

22837 STORY OF Be-CONTAINING ADDITIVES IN LARGE-CRYSTALLINE METALLIC TUNGSTEN. Millner, T. Acta Chim. Acad. Sci. Hung.; 82: No. 1, 1-9(1974).

Thermobalance measurements conducted about 1955 have indicated that the reduction of undoped WO_3 by dry H_2 produces a type of β-W which is stabilized by a small amount of oxygen and decomposes to stable α-W in the temperature range of 620-650°C. During the large-scale reduction process of tungsten in incandescent lamp factories, this type of β-W develops partly as a result of the presence of 20 Hg mm (2666 N/m^2) water vapor in the hydrogen which decomposes to α-W only above 750°C. This so-termed secondary β-W which develops from WO_2 over 650°C is stabilized by the K, Si, Al dopants of WO_3. The secondary β-W appears to be stabilized by "heterobridges," e.g., by those of W-O-Al etc., which are more stable than the W-O-W bonds. Looking for other tetravalent atoms which may result in a Si effect it was discovered that this is only yielded by bivalent Be. Be in a K, Be, Al dopant combination was found to aid the development of a large amount of secondary β-W similarly to the K, Si, Al combination. The large crystalline characteristics and primarily the strength of K, Be, Al-doped recrystallized tungsten wires are superior to those of the earlier K, Si, Al-doped tungsten wires. (Hung. Tech. Abstr.)

22838 METHOD OF MANUFACTURING COMPOSITE SUPERCONDUCTORS. Coles, W. D. (to Lewis Research Center). US Patent Application 510678. 30 Sep 1974. 10p.

Problems of magnetization and self-field instability in composite electrical superconductors are reduced or eliminated by an improved method for transposition of the filaments within the conductor. The method includes, as a first step, forming a composite strand by embedding superconductive filaments within a non-superconductive matrix. Filaments are arranged substantially parallel to the longitudinal axis of the conductor and form a linear, closed geometrical figure, such as a circle or square, in cross section. A twist is then imparted to the strand to transpose the filaments around the axis of the strand in a substantially helical path. A plurality of strands so produced are combined within an elongate non-superconductive matrix and arranged so that the strands are substantially parallel to the longitudinal axis of the matrix and form a linear closed figure. A twist is then imparted to the conductor so that each filament within the conductor is thus transposed along the axis of the conductor, and follows a modified helical path. (STAR)

22839 HOT WORKABILITY OF NIMONIC 115 AS A FUNCTION OF STRAIN RATE. Cederblad, N. (Aktiebolaget Atomenergi, Uddeholm, Sweden); Grant, N. J. Metall. Trans.; 6A: No. 8, 1547-1552 (Aug 1975).

The hot workability of Nimonic 115 was studied by means of very high strain rate stress rupture tests in the temperature interval 1323 to 1473°K at strain rates of 10^{-4} to 10 per s. Hot plasticity, measured as elongation and reduction of area at fracture, increased generally with decreasing strain rates. Maximum values of about 40 percent elongation and 70 percent reduction of area were obtained between 1398 to 1448°K for strain rates below about 1 per s. For higher rates of strain than about 1 per s, ductility at fracture fell sharply. Ductility above 1448°K was poor at all strain rates and fell to a minimum at 1473°K regardless of strain rate. The highest ductility values are associated with intermediate temperatures and intermediate strain rates where conditions are optimum for significant recovery without encountering grain growth. The presence of excess phases leads to severe intergranular embrittlement at the highest temperatures and strain rates. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 23369, 23375, 23570, 23617, and 23991.

22840 (BNL-19798) EFFECT OF METALLURGICAL TREATMENTS ON AC LOSSES OF Nb_3Sn BY SOLID STATE DIFFUSION PROCESS. Suenaga, M.; Garber, M.; Bussiere, J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 12p. (CONF-750716-2). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

It has been shown that ac losses in Nb_3Sn properly prepared can be made as low as other heat sources, such as dielectric and radiation losses, in a transmission line. One method for making low loss Nb_3Sn is by a solid state diffusion process, where Nb_3Sn is formed at a Nb–(Cu–Sn) alloy interface. Effects of various metallurgical treatments on ac losses of Nb_3Sn made by this process are reported, and the importance of surface conditions as well as bulk critical current densities, J/sub c/, in relation to the losses is discussed. (DLC)

22841 (BNL-20292) EFFECT OF METALLURGICAL TREATMENTS ON AC LOSSES OF Nb_3Sn PRODUCED BY THE SOLID STATE DIFFUSION PROCESS. Suenaga, M.; Bussiere, J. F.; Garber, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 15p. (CONF-750716-10). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

The metallurgical parameters varied were: Nb_3Sn formation temperature, heat treatment duration, Sn content of the Cu–Sn alloy matrix, and presence of Zr in the Nb cores. The 60-Hz losses can be made as low as 1 mu W/cm^2 at current densities up to approximately 600 rms A/cm and approximately 100 mu W/cm^2 at 1000 rms A/cm. To produce low losses, the heat treatment times should be short; Nb_3Sn growth rates should be fast; the Sn content should not be increased beyond the solubility limit; and 700°C rather than 800°C should be used. (DLC)

22842 (CALT-822-75) SUPERCONDUCTING COPPER-BASE ALLOY CONTAINING FILAMENTS OF V_3Ga. Chen, W. Y. K.; Tsuei, C. C. (California Inst. of Tech., Pasadena (USA). W. M. Keck Lab. of Engineering Materials). Jul 1975. Contract AT(04-3)-822. 22p. Dep. NTIS $4.25.

The preparation and the properties of copper-rich superconductors containing filaments of V_3Ga are described. The superconducting transition temperature is about 13°K. The critical current density at zero field and 4.2°K is as high as 2.9×10^4 A/cm^2 and decrease to 2×10^3 A/cm^2 at 60 kG. (auth)

22843 (CONF-701074–P3, pp 291-312) TEST OF REACTOR MATERIALS AT THE INSTITUTE OF NUCLEAR RESEARCH. Baran, Z.; Vechorkovskiy, M.; Galonzka, E.; Rootkovskiy, V.; Czina, F.; Torun, L.; Khaevska, E.; Hoffmann, A.; Shteke, V.; Shoolts, L. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Research programs are reported on control rod materials, properties of steels, properties of Al–Mg–Si alloys, corrosion of steel by liquid sodium, and properties of U-Mo and U-Cr fuels. (JRD)

22844 (CONF-701074–P3, pp 375-388) APPRAISAL OF EFFICIENCY OF AUSTENITE STEELS FOR ATOMIC POWER PLANTS WITH SODIUM COOLANT. Kapirin, G. N.; Gribov, N. N.; Balandin, U. F.; Shurakov, S. S.; Ivanova, T. I. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The efficiency of austenitic chrome-nickel steels used in atomic power plants with fluid sodium coolant is evaluated. These materials must possess good resistance to thermal fatigue and stability against the formation of cracks in welded joints during long use at 500 to 650°C. The quantitative appraisal methods for these characteristics and data obtained experimentally are examined. It is shown, that the steels of the types XI8H9 and XI6HIIM3 possess better mechanical characteristics for the projected use. (auth)

22845 (CONF-701074–P3, pp 461-479) HEAT RESISTANT STEEL FOR THE BODIES OF WATER COOLED REACTORS UNDER PRESSURE. Gorinin, I. V.; Belandin, U. F.; Zvezdin, U. I.; Razov, I. A.; Shurakov, S. S. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Processing of steels for construction of pressurized water cooled reactors is described. It has been shown that the TC class of steels used in the USSR for the building of reactor components provides high efficiency construction. Data is cited showing that TC steels possess the highest radiation stability in comparison with other steels used in worldwide reactor construction. The question of possible hydrogenation of steel by reaction with water at high temperatures after disturbance of the anti-corrosion layer was examined. (auth)

22846 (CONF-701074–P3, pp 648-680) PROCESSING OF STEEL FOR HOUSINGS OF ATOMIC REACTORS WORKING UNDER PRESSURE. Beichka, I.; Broomovskiy, M.; Fillip, R.; Indra, I. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The characteristics of five types of processed steels for reactor containment buildings are studied. Special attention is directed to the effects of original defects on the occurrence of brittle failure, and on radiation stability as affected by steel processing. (auth)

22847 (HEDL-TME-73-34) EFFECT OF CHEMISTRY VARIATIONS ON THE TENSILE PROPERTIES OF 20 PERCENT COLD WORKED 316 STAINLESS STEEL. Paxton, M. M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Mar 1973. 31p. Dep. NTIS $4.75.

The effect of alloy compositional variations on the 1400°F tensile properties of 20 percent cold worked type 316 stainless steel was determined. Forty-five different alloys were used with compositional variations in carbon, nitrogen, phosphorus, sulphur, boron, manganese, copper, silicon, molybdenum, cobalt, chromium, and nickel. The 0.2 percent yield strength varied linearly over certain compositional ranges for single elements. By assuming no interaction parameters, the 0.2 percent yield strength for any specific composition can be calculated by a simple summation. A multiple linear regression computer code yields the following equation: 0.2 percent yield stress equals 49,842 + 3258 (percent molybdenum) – 57054 (percent carbon) – 1307 (percent copper) + 42112 (percent nitrogen) + 2788 (percent silicon) + 790 (percent cobalt) – 670 (percent chromium). (auth)

22848 (KFKI–75-34) TOTAL ENERGY OF SIMPLE, TRANSITION AND RARE EARTH METALS AND THE IONIC RADII. Solt, G.; Kollar, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 20p. Dep. NTIS (US Sales Only) $4.00.

A simple model is presented that gives an overall, semi-quantitative description of the binding energy, equilibrium atomic radius, and bulk modulus for simple rare earth and III B–VI B transition metals as well, by making use only of the valency (column number in the Periodic Table) and the value of the ionic

(Pauling) radius. The two radius parameters of the modified empty-core potential are linearly connected in the model, and both are correlated with the experimental ionic radius. The model, besides giving reasonable results for most of the simple metals, reproduces fairly well the cohesive parameters of the rare earth elements, and the results are rather satisfactory also for transition metals up to the middle of each series. (4 figures, 3 tables) (auth)

22849 (LA-UR-75-750) OBSERVATIONS OF ASYMMETRY EFFECTS IN THE VELOCITY OF DESTRUCTION OF SUPERCONDUCTIVITY BY CURRENT IN TYPE II Ta WIRES. Overton, W. C. Jr., Weinstock, H.; Schuch, A. F. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 5p. (CONF-750811-2). Dep. NTIS $4.00.

From 14th international conference on low temperature physics; Leiden, Netherlands (14 Aug 1975).

The results of experiments on type-II Ta wires of 0.0254 cm diameter immersed in a liquid helium bath at a temperature between 2°K and T/sub c/ are reported in which velocities of thermal propagation were measured for both forward and reverse current directions and new effects were observed. The velocity in the parallel case is significantly higher than in the antiparallel case. (2 figures) (RWR)

22850 (LA-UR-75-751) INVESTIGATION OF THE SOURCES OF ASYMMETRY EFFECTS IN THE VELOCITY OF DESTRUCTION OF SUPERCONDUCTIVITY BY CURRENT IN TYPE II Ta WIRES. Overton, W. C. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 5p. (CONF-750811-1). Dep. NTIS $4.00.

From 14th international conference on low temperature physics; Leiden, Netherlands (14 Aug 1975).

The phenomenological theories for the velocity of destruction of superconductivity by current can be improved by taking into account the temperature dependences of the thermal conductivities K/sub N/(T), K/sub S/(T) and the specific heats C/sub N/(T), C/sub S/(T). In earlier works these quantities were usually evaluated at temperature T/sub t/, that of the center of the propagating normal(N)–superconducting (S) interface. It was found that the asymmetry in v observed in "dirty" type-II Ta wires could be tentatively explained by K/sub N/(I greater than I/sub t/; parallel case) greater than K/sub N/(I equals 0) and K/sub N/(I greater than I/sub t/; antiparallel case) less than K/sub N/(I equals 0) and propagating interface specific anomaly parameter A(parallel) greater than A(antiparallel) and the width of the propagating interface equals 2n' xi(T) with n' equals 10, where I/sub t/ is the current at the superconducting–mixed interface. (2 figures) (RWR)

22851 (LA-UR-75-1189) FRACTURE BEHAVIOR OF A Pt–30 PERCENT Rh–8 PERCENT W ALLOY BETWEEN ROOM TEMPERATURE AND 1300°C. Rohr, D. L.; Hecker, S. S. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. 21p. (CONF-750650-1). Dep. NTIS $4.25.

From 4th international colloquium of group theoretical methods in physics; Nijmegen, Netherlands (23 Jun 1975).

Pt–30 percent Rh–8 percent W alloys are being considered for structural applications in Radioisotopic Thermoelectric Generators (RTGs) for space nuclear power systems. To determine materials compatibility and structural properties thermally exposed tensile specimens were tested at temperatures between 23 and 1300°C. The specimens had been exposed as control specimens or in contact with graphite or $^{238}PuO_2$ (the radioisotopic fuel) at 900 and 1100°C for 2000 and 8000 h. The fracture behavior was brittle and intergranular below 250°C and between 900 and 1100°C, and ductile transgranular at 250 to 800°C and above 1100°C. Auger Electron Spectroscopy of freshly fractured specimens revealed segregation of phosphorus up to 11 atomic percent at the grain boundaries which appears to be responsible for the low temperature brittle fracture. Exposure to $^{238}PuO_2$ further embrittled this alloy at low temperatures. The high temperature brittle fracture behavior resembled that caused by liquid metals. (auth)

22852 (LA-UR-75-1347) ANOMALOUS THERMAL PROPERTY BEHAVIOUR OF URANIUM AT LOW TEMPERATURES. Sandenaw, T. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 13p. (CONF-750915-3). Dep. NTIS $4.00.

From fifth international conference on plutonium and other actinides; Baden-Baden, F. R. Germany (10 Sep 1975).

Low temperature heat capacity curves are presented for polycrystalline ^{235}U and ^{238}U metals in different microstructural states and of different purities. Thermal conductivity versus temperature curves are shown for low-purity, polycrystalline ^{238}U in the temperature range between approximately 80 and 373°K for metal having undergone varied fabrication procedures. Published information suggests that there will be no structural modification in very pure uranium below room temperature. The influence of impurities on low temperature transitions may be through their effects on dislocation formation. Thermal conductivity and heat capacity runs started at approximately 80°K, after holding specimens at the temperature of boiling liquid nitrogen, do not give results which match up with runs started below 36 to 43°K. Result of measurements started at approximately 80°K indicate that an ordering mechanism is predominating, with microstructure rather than purity being the important factor. This can be explained if ordering at approximately 80°K is through lattice imperfections remaining from prior specimen processing. The drop off in heat capacity appearing above 36°K in the C/sub p/ versus T curves of ^{235}U and ^{238}U suggest the possibility of: (1) heat evolution from a developing antiphase structure or (2) heat evolution similar to that noted with a quenched martensite. Physical property changes in ^{238}U at 250 to 270°K and at 325 to 350°K seem to be related to the heat evolution which starts at 36°K during adiabatic heat capacity measurements. The data from heat capacity and thermal conductivity measurements are analyzed to help explain the significance of the sometimes very slight physical property changes observed at 36 to 43, approximately 80, 250 to 270 and 325 to 350°K in uranium metal. (auth)

22853 (LA-UR-75-1354) ENTROPY CORRELATION FOR THE 4f AND 5f METALS: RELATION OF ELECTRONIC PROPERTIES TO METALLIC RADII, MAGNETIC TRANSFORMATIONS AND THERMODYNAMICS OF VAPORIZATION. Ward, J. W.; Hill, H. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 15p. (CONF-750915-4). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

Properties of lanthanides and actinides were investigated to establish thermodynamic correlations for elements in these groups. Results of the studies show that the diversity of the actinide series, at least from Ac through Pu, precludes the success of any one theoretical model for the thermodynamic properties of these metals. The entropy has been shown to be a property through which the diverse natures of these elements can be better understood. (auth)

22854 (LBL-3755) HEAT CAPACITY OF THE SUPERCONDUCTING KONDO SYSTEM (LaCe)Al_2. Bader, S. D.; Fogle, W. E.; Phillips, N. E.; Maple, M. B.; Luengo, C. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-ENG-48. 8p. (CONF-750816-1). Dep. NTIS $4.00.

From 4th international conference on chemical thermodynamics; Montpellier, France (26 Aug 1975).

Heat capacity measurements were made on several (LaCe)Al_2 alloys with Ce concentration varying from zero to above the turning point concentration of the re-entrant T/sub c/ vs Ce concentration curve. The measurements extend below the temperature of the maximum in C/sub n/, the normal-state heat capacity, and, for the one sample that shows re-entrant superconducting behavior, below T/sub c2/. Measurements were made on samples with 0, 0.193, 0.640, and 0.906 at. percent Ce substituted for La, in the temperature range 0.07 to 20 K, and in magnetic fields from 0 to 38 kOe. A complete analysis of the data on all samples shows that the lattice and normal state electronic heat capacities of the alloy samples are the same as those of pure $LaAl_2$. (3 figures) (RWR)

22855 (PEL–234) THERMODYNAMIC PROPERTIES AND PHASE DIAGRAM OF TERNARY SODIUM ALLOYS. III. The System Sodium + Mercury + Indium. Neethling, A. J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Jan 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

Electromotive force measurements in the temperature range 670 to 760°K have been used to determine the thermodynamic properties of the sodium in ternary mixtures of sodium + mercury + indium. The corresponding functions for the mercury and indium were calculated with Darken's method. Thermal analysis was used to determine the solid-liquid equilibrium surface for the system. (auth)

22856 (RD/B/N–3256) APPLICATION OF A TWO CRITERIA APPROACH IN CREEP. Goodall, I. W.; Townley, C. H. A. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Dec 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The examination of the results of recent experimental work on crack propagation at creep temperatures suggests a strong similarity to fast fracture at ambient temperature. It is possible to distinguish two extreme regions: fully ductile in which load carrying capacity is governed by nett section events and fully brittle where crack tip events dominate behavior. Between these

two extremes, there is a transition region in which both types of behavior play a part. Although there is insufficient data to establish quantitative relationships, it is possible to make qualitative predictions about the way in which changes in specimen size and specimen shape bring about a change from ductile to brittle behavior. A tentative method is suggested by which data from laboratory tests can be applied to predict the behavior of structures containing cracks. (auth)

22857 (RDT-M-3-4T(7-75)) NICKEL ALLOY SEAMLESS TUBES (ASME SB-163 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 5p. RSO.

A standard prescribing requirements for nickel alloy seamless tubes (ASME SB-163 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 3-4T dated January 1974. (JRD)

22858 (RDT-M-5-2T(8-75)) CARBON STEEL PLATES (ASME SA-516 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Aug 1975. 5p. RSO.

A standard prescribing requirements for carbon steel plates (ASME SA-516 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 5-2T, dated May 1973. (JRD)

22859 (RDT-M-5-20T(8-75)) NICKEL–CHROMIUM–MOLYBDENUM–COLUMBIUM ALLOY PLATE, SHEET, AND STRIP (AMS 5597 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Aug 1975. 4p. RSO.

A standard prescribing requirements for nickel–chromium–molybdenum–niobium alloy plate, sheet, and strip (AMS 5597 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 5-20T, dated January 1972. (JRD)

22860 (RDT-M-30T(8-75)) NICKEL–CHROMIUM–MOLYBDENUM–COLUMBIUM ALLOY SEAMLESS TUBES (AMS 5590 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Aug 1975. 5p. RSO.

A standard prescribing requirements for nickel–chromium–molybdenum–niobium alloy seamless tubes (AMS 5590 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 3-30T dated January 1972. (JRD)

22861 (Y-1978) NIOBIUM IN TUNGSTEN-3.5 NICKEL-1.5 IRON ALLOY. Ludwig, R. L. (Oak Ridge Y-12 Plant, Tenn. (USA)). 15 Aug 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

Tungsten–3.5 nickel–1.5 iron alloy normally possesses a high degree of tensile ductility and can be liquid-phase sintered in dry hydrogen. When prepared with tungsten from certain sources, the alloy may become brittle or develop surface blisters during sintering. The addition of niobium in concentrations of 200 to 2000 parts per million to alloys susceptible to these difficulties has served to overcome the embrittlement and sintering problems. Excessive quantities of niobium, however, tend to deteriorate the tensile properties of the alloy. (auth)

22862 MERCURY VAPOUR–PRESSURE MEASUREMENTS ON SOLID AND SOLID–LIQUID INDIUM AMALGAMS. Franck, G. Tech.-Wiss. Abh. Osram-Ges.; 11: 101-105(1973). (In German).

Using 2537 Å resonance absorption, Hg vapor pressures were measured on In/Hg amalgams with Hg contents between 1.9 and 20 at.% in the range 30 to 160°C. In the solid/liquid region the rise in Hg pressure levels off, and above 130°C, it falls with increasing temp. The observations are shown to be in good agreement with calculated values. (15 ref.) (Metals Abstr.)

22863 ISOTOPE EFFECTS ON THE MOTION OF O–H CLUSTERS IN Nb. Mattas, R. F. (Argonne National Lab., IL); Birnbaum, H. K. Contract AT(11-1)-1198. Acta Metall.; 23: No. 8, 973-977(Aug 1975).

The effect of isotope mass on the behavior of the O–H defect in niobium was studied using internal friction techniques. Large, nonclassical isotope effects were found for the jump frequencies, motion activation enthalpies, and binding enthalpies for the (100) tetragonal O–H and O–D defects. The theories of light element interstitial diffusion are not able to satisfactorily account for the observed effects. (auth)

22864 KINETICS OF PRECIPITATION OF CARBON IN MOLYBDENUM AT ABOUT 250°C. Yoshioka, K. (Tohoku Univ., Japan); Kimura, H. Acta Metall.; 23: No. 8, 1009-1015(Aug 1975).

The kinetics of the precipitation are studied in detail by resistivity measurements. The rate of this precipitation stage is controlled by the diffusion of carbon atoms. The activation energy for carbon diffusion at this temperature range is determined to be 1.2 eV, which is appreciably smaller than the activation energy reported so far for carbon diffusion measured at high temperatures, about 1.7 eV. (auth)

22865 ALTERNATIVE DESCRIPTION OF HYDROGEN DIFFUSION IN THE B.C.C. METALS. Steward, S. A. (Univ. of California, Livermore). Solid State Commun.; 17: No. 1, 75-78(1975).

A so-called triangular interstitial site in body-centered cubic materials provides a shortened diffusion path between tetrahedral sites, and it contributes to the concept of random location of cations in certain systems. The importance of the triangular site to metal–hydrogen systems is emphasized. Dirichlet cells are used to better illustrate the interrelationships of interstitial and atomic locations in cubic lattices. (auth)

22866 VANADIUM ALLOYS WITH THE STRUCTURE OF SOLID SOLUTIONS. Druzhinina, I. P.; Elyutin, A. V.; Per'kova, G. N.; Lalayan, M. S. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 37-44 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian)

22867 SOME PHYSICOCHEMICAL PROPERTIES OF VANADIUM-CHROMIUM ALLOYS. Druzhinina, I. P.; Vladimirskaya, T. M.; Andreeva, V. V.; Stepanova, T. P. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 81-86 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

22868 SOME PROBLEMS IN THE INFILTRATION OF TUNGSTEN WITH COPPER AND SILVER. Stolarz, S. (Instytut Metalurgii Zelaza, Gliwice (Poland)). Planseeber. Pulvermet.; 22: No. 3, 188-210(Sep 1974). (In German).

A survey is given on the research carried out in the Nonferrous Metals Institute at Gliwice in the field of tungsten infiltration with copper, silver, and copper alloys. The specimens were either dipped in the molten metal or solid infiltrant was placed on top of the skeletons. The infiltration was carried out in hydrogen and under vacuum. The effect of tungsten grain size, pressure, sintering temperature and infiltration time on the density, porosity, hardness, electrical conductivity, and erosion of the tungsten-copper, tungsten-silver and tungsten-copper-nickel materials was examined. (auth)

22869 PHASE DIAGRAMS OF THE $(Cd_3P_2)_{1-x}(2CdTe)_x$. Rigan, M. Yu.; Golovej, M. I.; Alekseenko, G. F. (Uzhgorodskij Gosudarstvennyj Univ. (Ukrainian SSR). Kafedra Khimii Poluprovodnikov). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 12, 1865-1866(1974). (In Russian).

The phase diagram of $(Cd_3P_2)_{1-x}(2CdTe)_2$ was investigated by microstructural and differential-thermal analysis methods, by measurements of the microhardness and density. It is a quasi-binary cross section of the ternary system Cd–P–Te with unlimited mutual solubility of the binary components in the liquid state and limited solubility in the solid state. (tr-auth)

22870 MERCURY VAPOR–PRESSURE OF INDIUM AMALGAMS AND THE LIGHTING CURRENT/TEMPERATURE CURVE OF THE NEW INDIUM AMALGAM LAMPS. Hofmann, D.; Rasch, E. G. Tech.-Wiss. Abh. Osram-Ges.; 11: 106-119(1973). (In German).

Plots of ambient temp. against relative lighting current for Hg vapor lamps of various types with pure Hg, In, and Cd amalgams, show that the In amalgam provides high light efficiency over a wide range of temp. This is caused by a vapor pressure anomaly of the two-phase liquid region of the In amalgam. Vapor pressure of the In amalgam in this region can be calculated from the Clausius–Clapeyron equation. Utilization of this effect enables Hg vapor lamps to be constructed in which the lighting current/temp. curve is twice as broad as those for normal Hg vapor lamps. (14 refs) (Metals Abstr.)

22871 SUPERALLOYS FOR SUPERSERVICE. Met. Prog.; 108: No. 3, 37-46(Aug 1975).

Properties of Fe-, Ni-, and Co-base superalloys are discussed. Their use in reactors, gas well cables, liquid metal pump impellers, aircraft cables, turbines and powder metallurgy parts is reviewed. (JRD)

22872 ALLOY SELECTION FOR EXHAUST VALVES. Kocis, J. F. (TRW Inc., Cleveland); Matlock, W. M. Met. Prog.; 108: No. 3, 58-60; 62(Aug 1975).

Methods of selecting materials for use in exhaust valves are reviewed. The designs considered are those for use in single alloys for light duty to multiple alloy composites for heavy duty compositions and properties of exhaust valve materials are tabulated and discussed. (JRD)

22873 ROLE OF VACANCY ANHARMONICITY ON NON-ARRHENIUS DIFFUSIONAL BEHAVIOR. Glider, H. M. (CEN, Fontenay-aux-Roses, France); Lazarus, D. Phys. Rev., B.; 11: No. 12, 4916-4926(15 Jun 1975).

Curvature in the Arrhenius plot of self-diffusion, usually attributed to the coexistence of two or more separate mobile defects, is shown to be explainable in terms of a single highly relaxed vacancylike defect, in which the anharmonicity of the lattice modes gives rise to a large thermal-expansion coefficient for the defect. A model based on this approach gives excellent agreement for all cases in which curvature has been observed, as well as for others in which no curvature has been detected. (auth)

22874 NOVEL SUPERCONDUCTING MATERIAL. Kawabe, U.; Fukase, S.; Ishibashi, M.; Kudo, M.; Takatoku, K. (to Hitachi, Ltd.). US Patent 3,884,683. 20 May 1975. Priority date 22 Jan 1971, Japan. 8p.

A superconducting material is described which consists essentially of the intermetallic compound (Nb/sub 1-x/Ta/sub x/)/ sub k/ Al/sub 1 - y/M/sub y/, where M is Be, B, Si, and C, and x, y, and k are 0 less than or equal to x less than or equal to 0.1, 0.01 less than or equal to y less than or equal to 0.2, and 2.3 less than or equal to k less than or equal to 4.0, respectively. This material has a higher critical temperature than that of the previously known Nb_3Al. (Official Gazette)

22875 THERMO-MECHANICAL TREATMENT OF ZIRCONIUM ALLOYS. Levy, I. S. (to Exxon Nuclear Co., Inc.). US Patent 3,884,728. 20 May 1975. Filed date 26 Feb 1973. 10p.

A zirconium alloy comprising at least 95 percent Zr (Zircaloy) which has been thoroughly annealed, is greatly increased in strength without substantial loss in ductility by subjecting it to tensile creep deformation in a temperature range in which creep will occur, yet which is below the temperature for significant recovery. (Official Gazette)

22876 EFFECTS IN A LONG SUPERCONDUCTIVE THREAD FORMED IN THE VOLUME OF A SEMICONDUCTOR. Benacka, S.; Bezakova, L.; Palaj, J. (Elektrotechnicky ustav, Bratislava). Elektrotech. Cas.; 26: No. 4, 282-289(1975). (In Czech).

The properties of long superconductive threads, formed by pulsing electrical breakdown of a semiconductor (Si) provided with contacts by a superconductor (Pb, Sn), were investigated experimentally. The formed structures have properties of the direct and alternating Josephson effects, a good time stability and reproducibility. The perspective of using the prepared structures is in low-temperature integrated circuits. (auth)

22877 GENERAL DATA ABOUT REFRACTORY STAINLESS STEELS AND SUPER-ALLOYS, AND DESCRIPTION OF A NEW WEAR AND HEAT RESISTANT MARTENSITE STEEL. Wagner, V.; Masi, A. Metall. Ital.; 67: No. 3, 121-125(Mar 1975). (In Italian).

A classification is shown, in which the steels and alloys are grouped for uses at higher temperatures, based on different temperatures of application and main alloying elements. Production details are then mentioned for such materials. Subsequently a special type of stainless steel, resistant to wear and heat, which, as chemical composition, might be classed as a stainless steel of series 440, with considerable Mo and V additions, as well as high speed steel of series M with a very high Cr content. This type of steel, owing to the high content of carbon and alloying elements, requires manufacturing methods of an advanced type, such as consumable electrode remelting under vacuum or under molten slag layer. The most significant parameters of this material are given concerning quality levels obtained through the techniques chosen for production (remelting under electroconducting slag) and for working. (auth)

22878 DEGRADATION BY WARM CREEPING OF MATERIALS USED IN STEAM DUCTS OF THERMOELECTRIC PLANTS. Di Pasquantonio, F.; Livraghi, M.; Regis, V. Metall. Ital.; 67: No. 3, 133-145(Mar 1975). (In Italian).

Thermal power plants with long-term operation need careful inspections of materials conditions. Methods of assessing structural stability and creep damage are described. A short account is given on creep mechanisms and kinetics together with data on steam piping design. An outline of the research carried out by some national and foreign research laboratories on residual life evaluation is presented. Most common extrapolation methods are discussed, also in connection with the effective significance of short-time creep rupture tests. Research carried out by ENEL on assessment of service materials and evaluation of residual life, experimental creep tests, and stress-analysis calculations by means of finite elements method applied to two- and three-dimensional structures are reported. (auth)

22879 REFLECTION OF ELECTRONS FROM SINGLE CRYSTALS OF A TUNGSTEN–TANTALUM ALLOY. Bronshtein, I. M.; Khinich, I. I.; Dyubua, B. Ch.; Karasik, B. S.; Solov'eva, G. S.; Terent'eva, L. M. (State Pedagogical Inst., Leningrad). Sov. Phys. - Solid State.; 16: No. 11, 2262-2263(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3487-3489 (Nov 1974).

Results of an investigation of the reflection of electrons from the (100) face of single crystals of the W–Ta 9% alloy and from single crystals of W are reported. The investigated crystals were spark-cut into pellets whose surfaces were polished electrochemically. The measurements were carried out in a quasispherical capacitor. Samples were placed in a special tantalum holder, which could be rotated about the axis of the capacitor. The angle of rotation was measured with a special optical system to within ±0.2°. The crystals were heated for several hours from the rear side by electron bombardment at T ≈ 2500°K. The dependences $r(E_p)$ were deduced from the pulsating current of the primary electrons from which the alternating component was separated by a selective system and recorded automatically by a plotting potentiometer. The retardation potential was selected so that, for all values of electron energy (E_p), it corresponded approximately to the onset of the steep part of the retardation curve. The residual gas pressure during the heating of a target and during measurements did not exceed 10^{-9} torr. It was found that an electron reflection model based on results can be used to predict only the general nature of the dependency of specularly reflected electrons on the primary electron energy. (JRD)

22880 CHANGE IN THE RATE OF PLASTIC FLOW AND THE KINETICS OF THE PLASTIC EFFECT IN SUPERCONDUCTORS. Bobrov, V. S. (Inst. of Solid State Physics, Moscow). Sov. Phys. - Solid State.; 16: No. 11, 2187-2188(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3375-3378(Nov 1974).

The graphical differential method has been used to study the rate of plastic deformation $\dot{\epsilon}_{pl}$ at the moment of superconducting SN and NS transitions. The studies were done for Pb and In samples under conditions of active deformation. The temperature dependence of the change of $\dot{\epsilon}_{pl}$ during SN transitions agrees well with the temperature dependence of the ratio of electron viscosities in the S and N states. This suggests that the mechanism for plastic deformation satisfies the condition $\dot{\epsilon}_{pl} \sim 1/B$ (B is the electron viscosity). Using models for viscous and thermally activated dislocation motion which satisfy this condition, a description is given of the kinetics of the change in the plastic flow stress σ in real deformation curves under conditions of superconducting transitions. Both models satisfactorily describe the kinetics of the change in σ but after the NS transition there is a somewhat sharper drop in σ than would follow even from the viscous model. This result agrees with data from direct measurements of the change of $\dot{\epsilon}_{pl}$ at the instant of an NS transition (for quite low T the change of $\dot{\epsilon}_{pl}$ during NS transitions is substantially greater than during SN transitions). There can be several reasons for this behavior: For example, an additional contribution to $\dot{\epsilon}_{pl}$ during NS transitions due to the delayed surmounting of barriers (dislocation which moves at the instant of the transition with increased σ which corresponds to an N state and small B which corresponds to an S state) or due to a quasistatic homogenization effect on the dislocation structure in the S state. (auth)

22881 LOW-TEMPERATURE SPECIFIC HEAT OF METALS. Masharov, N. F. (All-Union Scientific Inst. of Physicotechnical and Radio Engineering Measurements, Moscow). Sov. Phys. - Solid State.; 16: No. 11, 2147-2148(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3306-3309 (Nov 1974).

The low-temperature specific heat of metals including the contribution of the electron self-energy at nonzero temperature is calculated. It is shown that the contribution due to the electron–phonon interaction is important in the interpretation of the measured specific heat. (auth)

22882 EFFECT OF POLISHING MEDIUM ON THE NATURE OF THE SUBSTRUCTURE IN THE DEFORMATION OF TUNGSTEN SINGLE CRYSTALS. Rovinskii, B. M.; Baranov, Yu. V.; Kostyukova, E. P. Sov. Phys. - Solid State.; 16: No. 11, 2087-2089(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3207-3211 (Nov 1974).

An x-ray study has been made of the structural changes that take place in tungsten single crystals during their deformation by four-point bending with and without electropolishing. The flow stress in the bending of tungsten crystals varies in the polishing medium with the rate of removal of metal from the surface. X-ray topographical studies have revealed that there is a difference in the nature of the structure in the surface layers and in the body of tungsten crystals deformed by four-point bending with and without electropolishing. Electropolishing during deformation by bending leads to the appearance of mechanical polygonization in the surface layers of the crystals. (auth)

22883 NORMAL DOMAIN IN A TYPE I SUPERCONDUCTOR. Gal'perin, Yu. M.; Gurevich, V. L.; Kozub, V. I. (Ioffe Inst. of Physics and Tech., Leningrad). Sov. Phys. - Solid State.; 16: No. 11, 2275(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3502-3503 (Nov 1974).

A plate made of a type I superconductor and subjected to an external magnetic field H much lower than the critical field H_c is considered. It is assumed that at considerable distances from this plate the field H is perpendicular to the surface of the plate. However, close to the plate the lines of force should "flow around" the plate so that the magnetic field should be parallel to the plate's surface. It is concluded that a cylindrical domain should be stable because its division into several domains would have increased the surface energy. Moreover, a domain can move across a plate (for example, this can be done with a light beam) and the trapped magnetic flux can be retained in the domain. The position of such a domain can also be localized by making it coincide with an aperture in a plate. The existence of such a domain and its motion can be detected by the difference between the surface impedances of the superconductor and the normal metal in a magnetic field. (auth)

22884 NUCLEAR MAGNETIC RESONANCE IN SINGLE CRYSTAL TANTALUM. Huetter, K.; Karcher, R.; Lueders, K.; Szuecs, Z. (Freie Univ., Berlin). Phys. Status Solidi B.; 70: No. 1, K11-K14(1 Jul 1975).

The mechanisms of NMR linewidth broadening in Ta single crystals were studied. Data on the NMR signal in ^{181}Ta are presented in plots and discussed along with data in tables on second moments calculated for the direct dipole-dipole interaction for three orientations. Possible broadening mechanisms include direct dipole-dipole interactions, and the indirect interaction between the nuclear moments. (JRD)

22885 ELECTRON STRUCTURE OF ATOMS OF THE 3d TRANSITION METALS. Galperin, F. M. (State Univ., of Mordov, Saransk, USSR). Phys. Status Solidi B.; 70: No. 1, 227-236 (1 Jul 1975).

Electron structures (configurations) of the atoms of all the 3d transition metals are calculated. It is shown that the regularities to which the electron configurations of the atom of the crystalline elements (3d metals) follow are similar to those for free atoms in the Periodic Table of Elements. (auth)

22886 HEAT OF FORMATION OF LANTHANUM–LEAD ALLOYS. Ferro, R.; Borsese, A.; Capelli, R.; Delfino, S. (Univ, Genoa). Z. Anorg. Allg. Chem.; 413: No. 3, 279-284(Apr 1975).

In the La–Pb system the heats of formation were measured, using a differential direct isoperibol calorimeter, and checking composition and state of the samples by chemical metallographic and x-ray analyses. For the various compounds the ΔH (for the reaction among solid phases at 300°K) correspond to the following values (kcal/g·at.): $La_5Pb_3 = -17.25 \pm 0.5$, $La_4Pb_3 = -16.7 \pm 0.5$, $La_3Pb_4 = -16.5 \pm 0.5$, $La_3Pb_4 = -15.3 \pm 0.5$, $LaPb_2 = -14.4 \pm 0.5$, $LaPb_3 = -13.7 \pm 0.5$. Results are briefly discussed and compared with those calculated using the method suggested by MIEDEMA. (auth)

22887 SUPERCONDUCTOR Nb_3Sn MADE BY THE CHEMICAL VAPOR-DEPOSITION PROCESS: PREPARATION AND PROPERTIES. Cernusko, V.; Chovanec, F.; Jergel, M.; Polak, M.; Cabelka, D. (Elektrotechnicky ustav, Bratislava). Elektrotech. Cas.; 26: No. 4, 271-281(1975). (In Czech).

A short review concerning the preparation of superconducting Nb_3Sn tapes made by the vapor-deposition process is given. The results of critical currents measurement and their temperature and magnetic field dependence are also reported. The critical current density of the mentioned tapes is from the region of 5×10^8 to 1×10^9 A/m^2 for transverse magnetic field perpendicular to the surface of the tape. Having such properties, the Nb_3Sn tape is suitable for construction of superconducting magnets for high magnetic fields. (auth)

22888 MUTUAL DIFFUSION IN THE Zr–Nb SYSTEM. Balakir, E. A.; Zotov, Yu. P.; Malysheva, E. B.; Panchishnyi, V. I. Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 2, 126-128 (1975). (In Russian).

Mutual diffusion in solid Zr–Nb systems was studied at temperatures from 700 to 1500°C. The coefficient of mutual diffusion in systems based on Zr decreased 1.5 to 2 orders of magnitude with increase in Nb content from 10 to 40 at. %, but in systems based on Nb the dependence was weak. A possible reason for these results is the difference in annealing temperatures in solid solutions of different concentrations. The temperature dependence of the mutual diffusion coefficient was a straight line for different concentrations of the solid solutions within the limits of error of the measurements. (TTT)

22889 Cr AND Hf SOLUBILITY IN SOLID Cu. Drits, M. E.; Rokhlin, L. L.; Bochvar, N. R.; Lysova, E. V.; Rozenberg, V. M.; Nikolaev, A. K.; Shparo, N. B. (Inst. of Metallurgy, Moscow). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 2, 122-125(1975). (In Russian).

Data from metallographic analyses were used to construct isothermal sections at 900, 800, 600, and 400°C for Cu–Cr–Hf systems, and the partitioning and joint solubility of Cr and Hf in solid copper were determined. It was shown that Hf and Cr solubilities in this ternary solid solution are much lower than the solubility of these elements in the corresponding two-component systems. The solubility isotherms intersect at the point which determines the limiting saturation by Hf and Cr of the ternary solid solution at a given temperature, corresponding to the three-phase equilibrium $\alpha \rightleftharpoons \beta + Hf_2Cu_7$. (TTT)

22890 DIFFUSION INTERACTION OF HARD ALLOY BK COMPONENTS WITH TUNGSTEN. Mukha, I. M.; Globa, L. V.; Shcherbakova, L. I.; Mukha, N. I. Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 79-82(Apr 1975). (In Russian).

Studies of zones of diffusion interaction of the welded systems W/Co, WC/Co, and W/C showed the formation of solid solutions and intermetallic compounds according to their structural diagrams. Cubic tungsten carbide B–WC is formed in the zone of diffusion interaction of the welded system W–WC without participation of a third component. (auth)

22891 CHARACTERISTIC DEBYE TEMPERATURE AND BOND ENERGY IN METALS. Konyaeva, A. G.; Karpet'yants, M. Kh. Russ. J. Phys. Chem.; 48: No. 11, 1569-1571(Nov 1974).

Translated from Zh. Fiz. Khim.; 48: No. 11, 2651-2654(Nov 1974).

Assuming a proportionality between the characteristic Debye temperature Θ and the frequency of simple harmonic vibrations, a relationship was obtained between Θ and the bond energy of metal lattices which appears to be valid for most metals. Using this relationship, the previously unknown Debye temperatures of Fr (27°K), Ra (72°K), Sc (338°K), and Tc (600°K) were evaluated. (auth)

22892 IMPACT STRENGTH OF THE 28 CDV 508 STEEL, EVOLUTION OF THE SPECIFICATIONS. Metallurgical Consequences for Relaxation and Creep Properties. Boulisset, R. (Societe Creusot-Loire, 75 - Paris (France)). Mater. Tech.; 63: No. 3, 85-92(Mar 1975). (In French).

From 1st colloquium on bolting and metallurgy of iron; Lyon, France (17 Apr 1975).

The property for use aimed at the beginning of Cr–Mo–V steel manufacturing was its relaxation and creep properties. Studies show vanadium carbide as the main element for creep strength; the best efficiency being obtained with a precipitation made during the $\gamma \rightarrow \alpha$ transformation of cooling in the bainitic range. The other convenient factors to obtain a high creep strength are a high austenitizing temperature to dissolve all carbide before quenching and also a high room strength level. Extended use of bolting in a range of temperatures between 450 and 550°C produces an additional steel embrittlement. It has more or less harmful consequences for materials specially in transient periods before opening and after closing the turbine for inspection. The scope of the work is to determine the metallurgical conditions to perform this purpose and the consequences for relaxation and creep properties of steel. (FR)

22893 INVESTIGATION OF BASAL SLIP NATURE IN BERYLLIUM AND ITS ALLOYS. Avotin, S. S.; Papirov, I. I.; Tikhinskii, G. F.; Kapcherin, A. S. (Physical-Technical Inst., Kharkov). Phys. Status Solidi A.; 30: No. 1, 39-46(16 Jul 1975).

Temperature, velocity, and concentration dependences of the critical resolved shear stress were determined for basal slip of high-purity beryllium (99.99 and 99.95%), Be–0.23 at.% Cu, and Be–1.34 at.% Cu alloys. The activation volume and activation energy of the basal slip have been calculated. The latter increases from ≈0.5 eV in pure beryllium to 1.7 eV in Be–1.34 at.% Cu alloy. The basal slip in the pure metal and Be–Cu alloys is con-

trolled by the interaction of moving dislocations with impurity atoms. The characteristics and nature of the basal slip in beryllium and other metals with hexagonal lattice (Zn, Cd, Mg) are shown to be different. (auth)

22894 DISLOCATION SUBSTRUCTURES IN TANTALUM AND TANTALUM–NITROGEN ALLOYS DEFORMED AT 77°K. Welsch, G.; Gibala, R.; Mitchell, T. E. (Case Western Reserve Univ., Cleveland). Phys. Status Solidi A.; 30: No. 1, 117-132 (16 Jul 1975).

Dislocation arrangements produced by tensile deformation at 77°K of Ta–N alloy single crystals containing up to 15000 at ppM N were investigated by transmission electron microscopy. The structures are dominated by primary screw dislocations plus secondary screw dislocations, (100) reaction dislocations and debris in the form of dipoles and loops. The effect of increasing N content is to produce longer screw dislocations and decrease the amount of debris. In the most concentrated alloys are significant numbers of non-screw glide-loop ends seen. The most important effect of N is to decrease the amount of cross-slip by increasing the frictional stress acting on the screw dislocations. Edge dislocations are relatively unaffected. (auth)

22895 MAGNETIC ORDER AND MAGNETIC HISTORY EFFECTS IN $ThCo_{5x}Ni_{5-5x}$. Buscow, K. H. J. (Philips Research Labs., Eindhoven, Netherlands); Brouha, H.; Elemans, J. B. A. A. Phys. Status Solidi A.; 30: No. 1, 177-186(16 Jul 1975).

The magnetic properties of several compounds of the series $ThCo_{5x}Ni_{5-5x}$ were studied by neutron diffraction and magnetization measurements. For $x \geq 0.8$ the compounds are ferromagnets. For lower x-values there is an antiparallel orientation of the 3d moments residing at the 3(g) and 2(c) sites, respectively. There is a slight preference in occupation of the 3(g) sites by Co atoms. Associated with the change in magnetic order type is a discontinuous change in the concentration dependence of the magnetic ordering temperatures. A discontinuous change near x = 0.8 was also observed for the concentration dependence of the lattice constants and the compressibility. All magnetically ordered compounds investigated give rise to a negative pressure dependence of the ordering temperatures. Most of the compounds $ThCo_{5x}Ni_{5-5x}$ show very pronounced magnetic history effects in their magnetization versus temperature curves. It is proposed that these effects are due to the presence of narrow Bloch walls in these compounds. (auth)

22896 MOESSBAUER EFFECT STUDIES IN $EuIn_3$ AND $EuPb_3$. Goerlich, E. (Jagiellonian Univ., Krakow); Hrynkiewicz, H.; Kmiec, R.; Latka, K.; Tomala, K.; Czopnik, A.; Iliew, N. Phys. Status Solidi A.; 30: No. 1, K17-K20(16 Jul 1975).

The effective magnetic fields and isomer shifts in $EuIn_3$ and $EuPb_3$ were measured. Results are discussed and presented in plots of Moessbauer spectra, isomer shift vs effective magnetic field, and tables on Moessbauer measurements. (JRD)

22897 RELATIONSHIP BETWEEN RUPTURE LIFE AND CREEP PROPERTIES OF 2¼ Cr–1 Mo STEEL. Klueh, R. L. (Oak Ridge National Lab., TN). Nucl. Technol.; 26: No. 3, 287-296(Jul 1975).

Several investigators have demonstrated empirical relationships between creep and rupture properties for various metals and alloys. Empirical relationships between the rupture life, the minimum creep rate, and the time to the end of steady-state creep (start of tertiary creep) for four heats of normalized-and-tempered 2¼ Cr-1 Mo steel with different carbon contents were examined. The primary objective was the determination of the conditions that affect the correlation. The following relationships were obeyed: t/sub r/ equals C/epsilon/sub s/ and t_2 equals F/sub s/t/sub r/, where t_2 is the time to start tertiary creep, t/sub r/ is the rupture life, epsilon/sub s/ is the steady-state creep rate, and C and F/sub s/ are constants. The primary microstructural constituent (proeutectoid ferrite or bainite) of the matrix and the precipitates present in that matrix (before test or formed during test) played a significant role in the correlation of the data with the empirical relationships. (auth)

22898 INTERMETALLIC TERNARY PHASES WITH STOICHIOMETRIC RATIO 1:1:2 WITH STRUCTURE OF CsCl OR $AlCu_2Mn$ TYPE. Marazza, R.; Rambaldt, G.; Ferro, R. (Univ., Genoa). Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.; 55: No. 5, 518-521(Nov 1973). (In Italian).

Following compounds have been prepared: $ZrInNi_2$, $HfInNi_2$, $TlInCu_2$, $HfInCu_2$, $ZrAlAu_2$, $TlAlPd_2$, $ZrAlPd_2$, $HfAlPd_2$, $TlInPd_2$, $ZrInPd_2$, and $HfInPd_2$. They were found to be of the CsCl or of the $AlCu_2Mn$ types. Geometrical characteristics of all known CsCl and $AlCu_2Mn$ type ternary compounds are summarized and briefly discussed. (auth)

22899 INFLUENCE OF HEAT TREATMENT ON THE FATIGUE CRACK GROWTH RATES OF A SECONDARY HARDENING STEEL. Horn, R. M. (Univ. of California, Berkeley). Metall. Trans.; 6A: No. 8, 1525-1533(Aug 1975).

The relationships between microstructure and fatigue crack propagation behavior were studied in a 5Mo–0.3C steel. Microstructural differences were achieved by varying the tempering treatment. The amounts, distribution, and types of carbides present were influenced by the tempering temperature. Optical metallography and transmission electron microscopy were used to characterize the microstructures. Fatigue fracture surfaces were studied by scanning electron microscopy. For each heat treatment the fatigue crack growth properties were measured under plane strain conditions using a compact tension fracture toughness specimen. The properties were reported using the empirical relation of Paris [da/dN equals C_0DELTAK/sup m/]. It was found that secondary hardening did influence the fatigue crack growth rates. In particular, intergranular modes of fracture during fatigue led to exaggerated fatigue crack growth rates for the tempering treatment producing peak hardness. Limited testing in a dry argon atmosphere showed that the sensitivity of fatigue crack growth rates to environment changed with heat treatment. (auth)

22900 THERMAL EQUILIBRIA AND MECHANICAL STABILITY OF Ti_3Al PHASE IN Ti–Mo–Al ALLOYS. Hamajima, T. (Univ. of Bochum, Ger.); Weissmann, S. Metall. Trans.; 6A: No. 8, 1535-1539(Aug 1975).

The phase diagram of the isopleth section of the Ti–7 at. percent Mo–Al system was improved and expanded to include alloys up to 25 at. percent aluminum. The mechanical and thermal stability of alloys aged in the two-phase region, beta + Ti_3Al, was correlated to the microstructure. X-ray rocking-curve studies of the polycrystalline specimens showed that after 2 percent deformation of a Ti–7 Mo–16 Al alloy the beta matrix became preferentially plastically deformed, while the Ti_3Al particles functioned as hard particles undergoing little lattice distortions. (auth)

22901 HIGH-TEMPERATURE STRENGTH AND DUCTILITY INCREASES OF Ti–Mo–Al ALLOYS BY STEP AGING. Hida, M. (Okayama Univ., Japan); Weissmann, S. Metall. Trans.; 6A: No. 8, 1541-1546(Aug 1975).

Step-aging programs, based on principles of particle-dislocation interactions, were developed systematically to obtain increases in the high-temperature strength and ductility properties of Ti–7 at. percent Mo–Al alloys. A triple-step aging program applied to Ti–7 Mo–16 Al produced a yield stress $sigma_{0.2}$ equals 1,500 MN/m^2, elongation to fracture epsilon/sub F/ equals 4 percent at room temperature, and $sigma_{0.2}$ equals 900 MN/m^2, epsilon/sub F/ equals 12 percent at 600°C. A two-step aging program resulted in $sigma_{0.2}$ equals 1,350 NM/m^2, epsilon/sub F/ equals 5 percent at room temperature; $sigma_{0.2}$ equals 800 MN/m^2, epsilon/sub F/ equals 20 percent at 600°C. (auth)

22902 EXPLOSIVE STRENGTHENING OF A Cu–Be ALLOY. Nordstrom, T. V.; Rohde, R. W.; Mottern, D. J. (Sandia Labs., Albuquerque, NM). Metall. Trans.; 6A: No. 8, 1561-1568(Aug 1975).

The effects of shock loading on the mechanical properties and microstructure of a precipitation hardening copper 1.91 wt percent beryllium alloy were studied. Sheet samples suitable for tensile testing were explosively loaded to pressures of 10, 20, 30, 40, and 50 GPa. Subsequent tensile tests were performed on samples in the as-shocked and shocked plus aged conditions. Their properties are compared to those of material deformed by cold rolling and aged after cold rolling. The mechanical strength in the as-shocked condition increases linearly with pressure. The strength of the shocked plus aged material also increases with shock pressure but at a slower rate. Unaged material shocked to 50 GPa has a higher yield strength than material cold rolled 37 percent. However, the cold rolled material responds better to aging. In the aged condition, 37 percent cold rolled material is stronger than the material shocked to 50 GPa. Transmission electron microscopy reveals the onset of deformation twinning between 10 and 20 GPa. The volume fraction of twins and the dislocation density both increase with increasing shock pressure. The results indicate that deformation twinning has little significant strengthening effect in this system and that yield strength increases can be accounted for on the basis of increasing dislocation density. (auth)

22903 AGE HARDENING CHARACTERISTICS OF Nb-BASE ALLOYS CONTAINING CARBON AND/OR SILICON. I. (Nb–15 At. Percent Hf). Birla, N. C. (Univ. of Cincinnati); Hoch, M. Metall. Trans.; 6A: No. 8, 1631-1643(Aug 1975).

A study was made to investigate solutioning and aging reactions,

and their effects on microstructure and microhardness, in fifteen experimental Nb-base alloys, involving Nb–C, Nb–Si–C, Nb–Si, Nb–15 Hf, Nb–15 Hf–C, Nb–15 Hf–C–Si, and Nb–15 Hf–Si systems. Alloys were solution treated, quenched, then aged for 2 h at temperatures ranging from 800 to 1600°C, to examine the effect of temperature, and aged at 900 to 1100°C isothermally for times varying from 2 to 20 h. Hardness provided the means of evaluating structural effects. Microstructural changes were determined by optical and electron microscopy, and the phases were chemically extracted and identified by x-ray diffraction or electron diffraction. In general, all of the alloys containing hafnium exhibited age hardening characteristics. This age hardening appears to be due to precipitation of the complex monocarbide (Nb,Hf)(C,O,N) phase. Replacement of some of the carbon by silicon in the Nb–15 Hf–C alloy raises the overaging temperature from 800 to 1000°C and leads to strength retention for longer times as compared with the alloys which contain carbon only. Out of several alloys studied, the Nb–15 Hf–0.46 C–2.32 Si and Nb–15 Hf–1.31 C–0.96 Si showed the best aging characteristics. (auth)

22904 AGE HARDENING CHARACTERISTICS OF Nb-BASE ALLOYS CONTAINING CARBON AND/OR SILICON AS INTERSTITIALS. II. (Nb–33 At. Percent Hf). Birla, N. C. (Univ. of Cincinnati); Hoch, M. Metall. Trans.; 6A: No. 8, 1645-1652 (Aug 1975).

A study was made to investigate the solutioning and aging reactions and their effects on microstructure and microhardness in nine experimental Nb-base alloys involving Nb–33 Hf, Nb–33 Hf–C, Nb–33 Hf–Si, and Nb–33 Hf–C–Si systems. Alloys were solution treated, quenched, then aged for 2 h at temperatures ranging from 800 to 1600°C to examine the effect of temperature, and aged at 900 to 1100°C isothermally for times varying from 2 to 20 h. Microstructural changes were determined by optical and electron microscopy, the phases were chemically extracted and identified by x-ray diffraction, and hardness provided the means of evaluating structural effects. The Nb–33 Hf–Si and Nb–33 Hf–C–Si alloys exhibited age hardening characteristics, which appear to be due to the precipitation of complex monocarbide (Nb, Hf)(C,O,N), while Nb–33 Hf–C alloys showed separation of Nb_2C phase from (Nb,Hf)(C,O,N) on aging. (auth)

Radiation Effects

Refer also to abstracts 22764 and 24117.

22905 (BMI–1935) PROGRESS ON EVALUATING STRENGTH AND DUCTILITY OF IRRADIATED ZIRCALOY DURING APRIL THROUGH JUNE 1975. Quarterly Progress Report on Task Agreement No. 61. Bauer, A. A.; Lowry, L. M.; Perrin, J. S. (Battelle Columbus Labs., Ohio (USA)). Jun 1975. Contract W-7405-eng-92. 33p. NTIS $4.00.

Hardness tests of isothermally annealed irradiated Zircaloy fuel-rod cladding show that the hardness decreases gradually as the annealing temperature is increased from 850 to 1000 and 1150°F. No change occurs below 850°F and no further decrease occurs when the temperature is increased to 1300°F. The annealed hardness appeared to be dependent only on the temperature of annealing and not on the times of annealing, which ranged from 1/4 to 60 min at a given temperature. Tensile tests were conducted at 700°F on specimens of the same irradiated Zircaloy cladding. Tests of annealed specimens are planned. The 15 fuel rods that are to provide the major source of Zircaloy cladding for experimental purposes in the coming fiscal year were received at the BCL Hot Laboratory Facility. In order to characterize the cladding and provide guidance for sectioning the rods to obtain test specimens, the rods were nondestructively examined visually and by gamma scanning, profilometry, and eddy-current testing, and the rods were punctured for plenum-gas recovery. The design and construction of bend-test, expanding-mandrel, and transient-burst test apparatus is under way. (auth)

22906 (CONF-701074-P3, pp 417-429) PROTRACTED HARDNESS AND CREEPAGE OF NICKEL ALLOY IRRADIATED AT DIFFERENT TEMPERATURES. Votinov, S. N.; Shamardin, V. K.; Prokhorov, V. I. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The effects of neutron irradiation on the hardness and creep of the alloy X20H78T at 650°C were studied. Irradiation by integral flux $5.0 \times 10^{20} cm^{-2}$ (E 0.85 MeV) was carried out in the reactor SM-2 at 500 and 780°C. The behavior of nickel alloy X20H78T during yield strength experiments at 650°C after neutron irradiation at 500 and 780°C depends on the temperature of irradiation. The lowering of the yield strength after 500°C irradiation is noticeably greater than after irradiation at 780°C. (auth)

22907 (CONF-701074-P3, pp 430-460) INFLUENCE OF NEUTRON IRRADIATION ON HIGH-TEMPERATURE PROPERTIES OF STAINLESS CHROMIUM STEELS OF THE TYPE X13. Votinov, S. N.; Balashov, V. D.; Zinkovskii, V. I.; Krillov, E. A.; Prokhorov, V. I.; Shamardin, V. K.; Roshin, V. V.; Kazennov, U. I. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The effects of irradiation at different temperatures on the stress and strain properties of steels of the ferritic-martensitic class of the type X13 along with alloying additions Mo, Si, Nb, V, and B were studied. It was shown that neutron irradiation causes softening of chromium steels in the temperature range of 500 to 650°C. (auth)

22908 (CONF-701074-P3, pp 480-492) INVESTIGATION OF BEHAVIOR OF ZIRCONIUM ALLOYS IN THE CONDITIONS OF IRRADIATION AND THE COOLANT MEDIUM OF THE BOILING REACTOR. Belokopitov, V. S.; Votinov, S. N.; Andreeva, A. B.; Deribizov, M. D.; Shamadrin, V. K. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Results of investigations of zirconium + 1% niobium and zirconium + 2.5% niobium alloys are cited. The investigation was carried out on the samples, exposed 12000 hours to irradiation and the coolant medium of the boiling reactor VK-50. The resulting data on the corrosion stability and the results of the mechanical testing are compared with the data from autoclave and reactor loop tests of the zirconium alloys. On the basis of the analysis of the results an evaluation of stability of the alloys was made. Zr + 1% Nb and Zr + 2.5% Nb tested under normal conditions of the boiler reactor VK-50 showed little damage. (auth)

22909 (CONF-701074-P3, pp 493-513) EFFECT OF ISOCHRONAL ANNEALING ON THE STRESS-STRAIN PROPERTIES AND MORPHOLOGY OF HYDRIDE IMPURITIES IN THE IRRADIATED ALLOY Zr–1% Nb. Ivanov, E. G.; Elesin, L. A.; Lebedev, L. M.; Chizhaev, V. V. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The investigations were carried out by optical metallography, electronic microscopy in clear space, study of stress-strain properties, measurement of microhardness, and determination of the quantity of hydrogen. The presence of a considerable quantity of hydrogen in the irradiated alloy of zirconium with 1 weight percent of niobium changes the kinetics of annealing of defects in comparison with specimens containing less hydrogen, and in zircaloy-2 having large hydrogen content, the structure changes less on annealing. The appearance of dislocation loops with size up to 150 Å was observed after annealing at 300°C. The loops attain the maximum size (1000 Å) at 500°C. Subsequently, with the rise of temperature of annealing the loops disappeared, forming dislocation network. After annealing at a temperature higher than 550°C, change of morphology of hydride impurities was observed. At the annealing temperature of 800°C, the hydride impurities disappear permanently. The restoration of plasticity of alloy from zero to 10% after annealing at 450°C is effected by annealing of radiation damage in the structure of hydride impurities. (auth)

22910 (CONF-701074-P3, pp 514-549) INVESTIGATION OF RADIATION STABILITY OF TANK MATERIAL FOR A HEAVY WATER REACTOR. Votinov, S. N.; Sharov, B. N.; Tsikanov, V. A. 1970. Translated from Trudy Nauchno-Tekhnicheskoi

Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The stress-strain properties of Al-base alloy treated by hardening, natural aging, annealing at 230°C for 20 h, and irradiation in the SM-2 reactor were studied. Irradiation was carried out at the temperature 50 to 60°C in water, at 80 to 110°C in helium, at 110 to 130°C in water, and at 160 to 170°C in an inert medium. The integral neutron doses were in the range 3.1×10^{19} n/cm^2 to 1.6×10^{21} n/cm^2. It was shown that the change of strength, hardness, and plasticity characteristics of the Al-base alloy CAB-1 in the stabilized condition under irradiation at 80 to 150°C and neutron doses of 1.6×10^{21} n/cm^2 does not exclude the use of the alloy in the heavy water reactor. (auth)

22911 (CONF-701074-P3, pp 550-585) STUDY OF POROSITY IN STEELS IRRADIATED IN CYCLOTRON. Agapova, N. P.; Sokurskii, U. N.; Butra, F. P.; Omufriev, V. D.; Mironova, E. G. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Steel specimens irradiated by He ions were studied. Results show a sharp fall of relative elongation of specimens of steel OX16H15M3B, irradiated by helium ions with the energy 42 MeV. Nucleation and development of helium porosity in the process of high-temperature deformation and annealing at 800 and 950°C were investigated. Acceleration of the growth of pores by two orders in the process of deformation at 800°C was discovered. Embrittlement at 800°C does not depend on whether helium exists in solid solution or only in the pores, but on the size of the pores. Comparison of speed-torque characteristics of specimens, irradiated by helium ions to a concentration of 0.012 at. % in the cyclotron, and by neutrons to a dose of 1×10^{22} n/cm^2 in the reactor SM-2 shows that the formation and accumulation of helium in OX16H15M3B steel may be considered as one of the main reasons of high-temperature radiation embrittlement. (auth)

22912 (CONF-701074-P3, pp 681-694) RADIATION STABILITY OF CHROME-MANGANESE STEELS. Votinov, S. N.; Sotnichenko, A. L.; Prokhorov, V. I.; Yarkovoi, V. S.; Feenko, A. G. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The effects of neutron irradiation at 50 to 70 and 650 to 660°C in the reactor SM-2 on the properties of chrome-manganese steels AC-9 and AC-43 were investigated. AC-9 and AC-43 are chrome-manganese austenitic steels, in which the basic alloying components are chrome (17.5 to 18.5% weight), manganese (14 to 16%), and nitrogen (0.35 to 0.45%). In both the markings the content of hydrogen does not exceed 0.06%. In steel AC-43, the nickel content is 0.9% while in steel AC-9 the nickel content is 10%. The results show high-temperature radioinduced lowering of plasticity in nickel-free materials and lead to the conclusion that the presence of nickel in alloys is not a necessary condition of embrittlement. The main reason of the effect is the tendency of steels towards grain boundary deterioration in unirradiated condition. The difference in the post-irradiation behavior of both steels is considered on the basis of the peculiarities of their microstructure. (auth)

22913 (CONF-701074-P3, pp 723-734) EFFECT OF IRRADIATION IN THE REACTOR ON THE SURFACE STRUCTURE OF IRON AND STAINLESS STEEL. Theodoresku, I. A.; Vassiliu, I. F. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Radiation effects on steel surface properties were studied. Experiments, conducted in the residual gamma-flux of a reactor and with a source ^{60}Co, and their comparison with the results of irradiation of specimens in reactor under similar conditions showed that gamma radiation affects the initiation and kinetics of metal–gas reactions on the surface of iron and stainless steels. The metal–gas reaction is induced by photoelectrons or compton electrons which ionize molecules in the irradiation chamber. The main role is played by short-lived products, obtained by radiolysis of various components of irradiation atmosphere (radicals OH, HO_2 etc). These radicals are active cathode depolarizers and facilitate activation of the cathode process of electron assimilation. The formation of oxidizing agents in the cathode zone explains the formation of thin oxide films. (auth)

22914 (CONF-701074-P3, pp 735-760) EFFECT OF NEUTRON IRRADIATION ON THE PROTRACTED STRENGTH OF AUSTENITIC STAINLESS STEELS. Votinov, S. N.; Gorinin, I. V.; Nikoleav, V. A.; Prokhorov, V. I.; Razov, I. A. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Experimental data on the change of high-temperature stress-strain properties of a series of austenitic steels under the influence of neutron irradiation are presented. In case of X18H9 steel, lowering of plasticity was revealed by tests involving short-time tensile stress, and long-term yield strength after irradiation in the reactor. The high tensile steels X15H35B3T and X15H35M2TI05 as a result of irradiation show significant lowering of plasticity and long-term strength. (auth)

22915 (CONF-701074-P3, pp 761-784) EFFECT OF NEUTRON IRRADIATION IN WATER OF HIGH PARAMETERS ON CORROSION STABILITY AND STRESS-STRAIN PROPERTIES OF STEEL 15XM0A AND METAL OF ITS WELDED SEAMS. Alekseenko, N. N.; Balandin, U. F.; Efimov, A. V.; Razov, I. A. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Results of an investigation of the effects of neutron irradiation on the corrosion stability and stress-strain properties of steel 15X3M0A during autoclave testings in water were examined. The increase under irradiation of the rate of corrosion of steel 15X3M0A and its dependence on the contents in water of acid and chlorides, and the value pH, were established. The transition under the influence of neutron irradiation was shown by initiation of pitting corrosion. The simultaneous effects of water, mechanical stresses, and neutron irradiation on steel lead to more change of stress-strain properties such as plasticity, than do these factors acting singly. (auth)

22916 (LBL-3590) IRRADIATION INDUCED DISLOCATION CLIMB IN Cu–Al ALLOYS OF DIFFERENT STACKING FAULT ENERGIES. Kosel, T. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-eng-48. 105p. Dep. NTIS $8.25.

Thesis.

Irradiation induced climb of dislocations due to preferential absorption of interstitials was studied by irradiating Cu–Al alloys of different stacking fault energies. Nucleation of rhombus shaped perfect dislocation loops was observed, and their growth was studied. The sides of the loops lay accurately on the two (111) planes which contain the Burgers vector and were often bowed out slightly on these glide planes. Rotation of the loops on the glide cylinder away from the pure edge orientation was observed, as well as loss of loops by slip along the glide cylinder to the foil surface. These observations suggest that the jog density on the loop sides is low. It is shown that at a given temperature there exists a minimum damage rate for growth, and that this is strongly dependent on stacking fault energy. This is discussed in terms of a model in which the rate controlling process in the climb of these loops is assumed to be the nucleation of jogs. (auth)

22917 (UCLA-34P172-14) PARTICLE SIZE DISTRIBUTION EFFECTS IN PRECIPITATION HARDENING. Sixth Annual Progress Report, 16 January 1974–15 January 1975. Ardell, A. J. (California Univ., Los Angeles (USA). Dept. of Materials). Jan 1975. Contract AT(04-3)-34. 71p. Dep. NTIS $6.75.

Results on single-crystal specimens of the isothermally aged

Ni-6 w/o Al alloy are described. In particular, the effect of the width of the particle size distribution (expressed through the standard deviation, σ) is described. The experimental work on the effect of bimodal distributions of γ' precipitates on the critical resolved shear stress (CRSS) of aged Ni–Al single crystals is described. Work on irradiation induced void and dislocation loop formation in γ/γ' alloy is reported. Also included is a brief description of some observations on irradiation effects in Ni–Si alloys. (auth)

22918 INFLUENCE OF NICKEL, COPPER, AND PHOSPHORUS ON RADIATION EMBRITTLEMENT OF FERRITIC–PEARLITIC STEEL. Nikolaev, V. A.; Badanin, V. I. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1267-1270(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 491-494(Dec 1974).

Laboratory-smelted Cr–Mo steel (0.12-0.20%C, 2-3% Cr, 0.6-0.8% Mo) with added V, Ni, and Cu was used as the base composition. Different amounts of P were added. To simulate other impurities, up to 0.003% Sb and Sn were added to one melt. Neutron radiation embrittlement was estimated from changes in the critical brittleness temperature (impact toughness = 50% max value). Results confirm that the embrittlement increases with high Cu and P contents; Ni is another element which increases the embrittlement. The effect of Cu and Ni in the absence of other impurities disappears at higher irradiation temperatures. It is suggested that the embrittlement is influenced by Cu dissolved in ferrite. (DLC)

22919 VACUUM HEATING OF SILVER FILMS WITH INTERSTITIAL HELIUM PARTICLES. Tishchenko, L. P.; Peregon, T. I.; Zats, A. V.; Fogel, Ya. M.; Martynov, I. S.; Seryugin, A. L. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1271-1273(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 494-495(Dec 1974).

Ag films 700-900 Å thick were irradiated by He^+ ions at 7 to 10 keV. Desorption spectra of He from the irradiated films were registered at 290 to 1370°C and a heating rate of 1°K/s. Electron microscopy showed no He bubbles in the films irradiated at room temperature, but heating resulted in bubble formation. The 900-Å film irradiated at 10 keV had its main desorption peak at ~ 450°K, while the other irradiated films (8 keV, 800 Å thick) had theirs at ~ 1000°K. Possible reasons for this difference are discussed. (DLC)

22920 X-RAY STUDIES OF DEFECT CLUSTERS IN COPPER. Larson, B. C. (Oak Ridge National Lab., TN). J. Appl. Crystallogr.; 8: 150-160(Apr 1975).

X-ray diffraction techniques provide powerful tools for the study of lattice defects in crystals. For the case of clustered defects, many of these techniques are based on the scattering properties of the strained regions surrounding the defects rather than on the scattering from the defects themselves. This is particularly true of Huang diffuse scattering, anomalous transmission, and lattice-parameter measurements; the interpretation of these measurements, therefore, relies on a detailed knowledge of the strains around the defects. The Fourier-transformed, long-range strain fields entering into the Huang diffuse scattering can be expressed in terms of the dipole force model, and in this work comparisons of calculations based on this model with measured scattering from spherical precipitates and dislocation loops in copper are reviewed. The use of integral diffuse scattering measurements, made with a two-axis diffractometer, are discussed in terms of a direct analysis of the defect systems in the form of defect concentrations and size distributions and this procedure is applied to the study of the effects of irradiation conditions and post-irradiation annealing on the defect distributions in neutron-irradiated copper. The relation of these diffuse scattering measurements to lattice parameter, anomalous transmission, electron microscopy, and electrical resistivity measurement is also discussed. (auth)

22921 PREFERENTIAL TRAPPING OF INTERSTITIALS AT DISLOCATIONS. Heald, P. T. (Central Electricity Generating Board, Berkeley). Philos. Mag.; 31: No. 3, 551-558(Mar 1975).

The growth of microscopic voids during the irradiation of metals is due to the preferential drift of interstitials to dislocations, thus allowing the excess vacancies to accumulate at voids. The preference arises from the stronger interaction between a dislocation and an interstitial than between a dislocation and a vacancy. This interaction is evaluated explicitly for several pure metals and the corresponding dislocation preference is calculated from a solution of the appropriate diffusion equation which includes the dislocation-point defect interaction term. The values of the dislocation preference calculated here are considerably larger than the values deduced from experimental results. (auth)

22922 EFFECT OF FAST REACTOR FLUENCE ON POST-IRRADIATION RUPTURE OF TYPE 316 STAINLESS STEEL. Lovell, A. J. (Westinghouse Hanford Co., Richland, WA). Nucl. Technol.; 26: No. 3, 297-306(Jul 1975).

Specimens of annealed Type 316 stainless steel were irradiated in Experimental Breeder Reactor II at temperatures ranging from 900 to 1450°F and to fluences from 0.2 to 7 x 10^{22} N/cm^2 (E/sub n/ greater than 0.1 MeV). Uniaxial and biaxial creep tests were performed at 1000, 1100, 1200, and 1400°F with rupture times from less than 1 to greater than 1000 h. The test data show that rupture life changes due to irradiation can be substantial. The stress, fluence, and temperature dependence of rupture life are reduced to a mathematical form, t/sub r/ equals A(t/sub 1//t/sub n/)sigma/sup/B/, where A and B are temperature-dependent terms and the term t/sub 1/t/sub n/ is temperature and fluence dependent. (auth)

Other Materials

Refer also to abstracts 22001, 22759, 23294, and 23295.

22923 (CONF-701074-P3, pp 586-599) MECHANISM OF RADIATION DAMAGE AND SERVICE-LIFE OF CONSTRUCTIONAL GRAPHITES AT HIGH TEMPERATURES AND NEUTRON FLUXES. Klimenkov, V. I.; Zolotookhin, V. R. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Radiation damage at high temperatures, which limits the efficiency of artificial polycrystalline graphite as a reactor construction material is examined. A proposed generalized diagram of deformation associated with the neutron flux and temperature resulting from competing action of these mechanisms is described. The original defects, controlling the crystal structure of the artificial polycrystalline graphite, radiation defects changing the original defect structure, and radioinduced micro-stresses, are examined. High-temperature irradiation is treated as continuous annealing of the radioinduced defects determining the net radiation damage at high integral neutron fluxes. Data showing radioinduced graphitization, which improves the configuration of atoms in the basic planes and the reconstruction of intercrystalline bonds, are given. Graphite swelling as a result of pore and microcrack formation is examined. (auth)

22924 (ORNL-tr-4013) EFFECT OF RADIATION DEFECTS ON RADICAL RECOMBINATION LUMINESCENCE. Bazhin, A. I.; Brik, O. G. Translated by M. Gerrard from Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 5, 790-793(1973). 4p. Dep. NTIS $4.00.

Radical-recombination luminescence (RRL) was studied in a phosphor crystal ZnSCdS–Cu irradiated with 1-keV protons. The RRL intensity changes in three stages corresponding to formation of intrinsic radiation defects. Because of the RRL surface character this method may be applied to study surface radiation defects in solids. (2 figures) (auth)

22925 (UCRL-51862) MULTIPHONON RELAXATION AND EXCITATION TRANSFER IN RARE-EARTH DOPED GLASSES. Layne, C. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Jul 1975. Contract W-7405-eng-48. 64p. Dep. NTIS $5.45.

Thesis.

The theory of multiphonon relaxation for rare-earth ions in crystals is extended to nonradiative relaxation in glasses. The expected exponential dependence of the multiphonon rates on energy gaps was verified for 5 oxide glass compositions; the active phonons were identified to be the high-energy molecular vibrations of the network forming ions. The multiphonon rates are determined by the highest phonon energies, with the rates in borate glasses being 10^3 times these in tellurite glasses; they are much faster than in crystals. Coupling of the rare earth to phonons is relatively constant in oxide glasses, but may vary in halide or chalcogenide glasses. The influence of nonradiative rates on the performance of a Nd : glass laser is assessed, with the theory being verified. Energy transfer in Nd : glass accounts for the observed nonexponential fluorescence decay of excited Nd ions. Coupling between Nd ions is due to dipole-dipole interaction. Lifetime decreases with Nd content. Results can be used to predict the fluorescent behavior and performance of new laser glasses. Energy transfer from Ce to Nd in laser glass was observed. (DLC)

22926 (UCRL-51868) SHOCK COMPRESSION PARAMETERS FOR A BORON-LOADED, SILICONE-RUBBER COMPOSITE. Gust, W. H.; Van Thiel, M.; Gathers, G. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jul 1975. Contract W-7405-Eng-48. 12p. Dep. NTIS $4.00.

Hugoniot parameters under uniaxial-shock-wave-loading from 0.03 to 0.6 Mbar are presented for a composite with 70 wt percent boron loaded in a silicone-rubber matrix. The plot of shock velocity vs particle velocity was found to be nonlinear. Equations that describe fits of the data are presented. (auth)

22927 (Y-DA-6225) SCALEUP OF GRAPHNOL AT Y-12. Pollock, C. B.; Overholser, L. G. (Oak Ridge Y-12 Plant, Tenn. (USA)). [nd]. Contract W-7405-eng-26. 7p. (CONF-750322-1). Dep. NTIS $4.00.

From conference on Navy strategic systems exploratory development programs review; Silver Spring, Maryland, USA (18 Mar 1975).

GRAPHNOL graphite is based on the use of low-fired filler or green cokes that behave like a sinterable ceramic, yielding a monolithic graphite structure after final firing. A study was made of the feasibility of scaling the process to yield full-size blocks in a reproducible manner. About 20 full-size billets were fabricated, many of which have slight defects (chipped edges, small surface cracks), but the majority of the billets are sound. The final density is not yet satisfactory, and impregnation is being attempted. Defects relating to segregation of fines is now the major priority. (DLC)

22928 V^- AND V^0 CENTERS IN CaO SINGLE CRYSTALS. Abraham, M. M. (Oak Ridge National Lab., TN); Chen, Y.; Boatner, L. A.; Reynolds, R. W. Solid State Commun.; 16: No. 10/11, 1209-1213(1975).

The stable, intrinsic V^- center in CaO single crystals was produced at room temperature by high-dose 2-MeV electron irradiation. This center, which consists of a hole trapped at an oxygen ion adjacent to a calcium vacancy, exhibits an EPR spectrum at 77°K which has (100) axial symmetry and is described by S equals ½, g/sub parallel/ equals 2.0021(2), and g/sub perpendicular to/ equals 2.0697(2). At room temperature, the spectrum consists of a single thermally averaged isotropic line at g equals 2.047(1). Upon gamma-irradiation at 77°K, the isolated V^- concentration is reduced and V^0 centers (pairs of trapped holes at single vacancies) are produced. A room-temperature thermal anneal reverses the effect of the low-temperature gamma-irradiation. (auth)

22929 DIFFUSION OF ION-IMPLANTED B IN HIGH CONCENTRATION P- AND As-DOPED SILICON. Fair, R. B.; Pappas, P. N. (Bell Labs., Reading, PA). J. Electrochem. Soc.; 122: No. 9, 1241-1244(Sep 1975).

The diffusion of ion-implanted B in Si in the presence of a uniform background of high concentration P or As was studied by correlating numerical profile calculations with profiles determined by secondary-ion mass spectrometry (SIMS). Retarded B diffusion is observed in both As- and P-doped Si, consistent with the effect of the local Fermi-level position in the Si band gap on B diffusivity, D/sub B/. It is shown that D/sub B/ is linearly dependent on the free hole concentration, p, over the range 0.1 less than p/n/sub ie/ less than 30, where n/sub ie/ is the effective intrinsic electron concentration. This result does not depend on the way in which the background dopant has been introduced (implantation predeposition or doped-oxide source), nor the type of dopant used (P or As). (auth)

22930 HYDROTHERMAL EPITAXY: AN IMPROVED TECHNIQUE FOR MASS PRODUCTION OF GARNET FILMS. Ferrand, B. (CEA, Grenoble, France); Geynet, J.; Challeton, D.; Daval, J.; Toudic, Y.; Bayon, J. F.; Regreny, A.; Passaret, M. Mater. Res. Bull.; 10: No. 8, 819-823(Aug 1975).

Hydrothermal epitaxy was used in view of the mass production of magnetic garnet films. A lot of films with $(Er,Gd)_3(Fe,Ga)_5O_{12}$ compositions were obtained by series of twenty in the same run, in a two liters autoclave by the "exchange reaction" method. According to the growth conditions, thicknesses and bubbles diameters are in the 1 to 3 mu range. The properties of twenty films grown in the same run are given and compared. The quality of these films for bubbles applications are then discussed. (auth)

22931 CONTROL OF THE PROPERTIES OF MAGNETIC GARNET FILMS. Kasai, T. (Hitachi, Ltd., Chiba, Japan); Ishida, F. Mater. Res. Bull.; 10: No. 8, 807-813(Aug 1975).

Large numbers of magnetic garnet films having essentially identical properties can be prepared from the same melt using the conventional liquid phase epitaxy dipping technique, in which substrate rotation rate is adjusted to compensate for the difference between the growth temperature and the objective, so that the growth rate can be completely controlled. Melt compositional drift was suppressed by the periodic addition of garnet oxides and flux to the melt. Results are presented for $Y_{2.5}Sm_{0.5}Fe_{3.5}Ga_{1.2}O_{12}$ films. (auth)

22932 NEUTRON ATTENUATING CONSTRUCTION MATERIAL. Bon, C. K.; Moolenaar, R. J. (to Dow Chemical Co.). US Patent 3,884,839. 20 May 1975. Filed date 16 Apr 1971. 4p.

A structural body to absorb neutrons and a method of producing the body are described. Such method involves impregnating a porous ceramic body with selected hydrogen and/or boron containing compounds substantially chemically inert to the body. (Official Gazette)

22933 METHOD OF MANUFACTURING A THIN SHEET OF BERYLLIUM OR AN ALLOY THEREOF. Suzuki, K. (to Nippon Gakki Seizo Kabushiki Kaisha). US Patent 3,895,671. 22 Jul 1975. Priority date 15 Nov 1972, Japan. 2p.

A method is described of manufacturing a thin sheet of Be or Be alloys which comprises depositing beryllium or an alloy thereof on a substrate bearing a prescribed shape, in vacuum and separating the deposited thin sheet of beryllium from the substrate. (Official Gazette)

22934 AIR-STABLE COMPACT OF COBALT-RARE EARTH ALLOY PARTICLES AND METHOD. Smeggil, J. C.; Charles, R. J. (to General Electric Co.). US Patent 3,892,599. 1 Jul 1975. Filed date 14 Mar 1974. 10p.

A process is described for producing novel air-stable magnetic products. An organometallic compound which decomposes at a temperature below 500°C is mixed with particles of a transition metal-rare earth alloy. The resulting mixture is pressed to form a green body, which is then heated to decompose the organometallic compound to produce a metal vapor that deposits an interconnecting metal coating on the exposed surfaces of the pressed particles. (Official Gazette)

22935 ANNEALED COATED AIR-STABLE COBALT-RARE EARTH ALLOY PARTICLES. Smeggil, J. C.; Charles, R. J. (to General Electric Co.). US Patent 3,892,600. 1 Jul 1975. Filed date 14 Mar 1974. 12p.

A process is described for producing novel air-stable coated particles of a magnetic transition metal-rare earth alloy. An organometallic compound which decomposes at a temperature below 500°C is heated to produce a metal vapor which is contacted with particles of a transition metal-rare earth alloy to deposit a metal coating thereon. The coated particles are heated at a temperature ranging from 50 to 200°C for a period of time sufficient to increase their intrinsic coercive force by at least 10 percent. (Official Gazette)

22936 INTERACTION OF NUCLEAR FISSION FRAGMENTS WITH A LAYER OF A GYPSUM SINGLE CRYSTAL. Geguzin, Ya. E.; Vorob'eva, I. V. (Gorky State Univ., Kharkov). Sov. Phys. - Solid State.; 16: No. 11, 2264-2265(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3489-3492 (Nov 1974).

Experiments were conducted to detect the orienting effects of crystal lattices on the formation of surface tracks (5 tracks) by fission fragments in gypsum. The source of fragments was ^{252}Cf, which produced a diffuse flux of $\approx 10^5$ fragments per hour in a solid angle of 2π. The experiments involved the following sequence of operations: a naturally cleaved surface of a gypsum single crystal was irradiated and then examined using an electron microscope by the shadow replica method; this was followed by a statistical analysis of the electron micrographs. The main result was that, against a background of randomly oriented short S tracks, anomalously long S tracks whose directions were close to the [010] axis were observed. The maximum deviation from this direction did not exceed ≈1°. Sometimes tracks of this kind could be followed throughout their length. However, more frequently they consisted of two forks oriented in diametrically opposite ways. Results of comparison of micrographs suggested that forks observed were the tracks of the entry and exit of the same fragment. The forks formed as a result of electrostatic scratching of the surface by a charged fragment traveling in the direct vicinity of the surface and the consequent bulging of the surface by a fragment moving just above it. (auth)

22937 ELLIPSOMETRIC DETERMINATION OF THE OPTICAL CONSTANTS OF β BORON. Yarovaya, R. G.; Tsomaya, K. P.; Shklyarevskii, I. N.; Gabuniya, D. L. (Gorky State Univ., Kharkov). Sov. Phys. - Solid State.; 16: No. 11, 2291-2292(May 1975).

Translated from Fiz. Tverd. Tela.; 16: No. 11, 3522-3524(Nov 1974).

The optical constants of a coarse-grained sample of p-type boron with a resistivity of 5×10^6 Ω/cm were determined directly. A boron powder was compacted in a molybdenum tube and fired at 2000°C and then remelted by the floating-zone method using an electron beam in an enclosure kept at a residual pressure of

5×10^{-5} torr. Results of vacuum melting analysis indicated the presence of considerable amounts of gaseous impurities such as hydrogen, oxygen, and nitrogen. The other impurities were mainly metals, the chief of which was molybdenum. Results are presented in dispersion curves and permittivity vs wavelength curves are discussed. (JRD)

22938 EFFECT OF THERMAL PROCESSING ON ELECTRICAL PROPERTIES OF IRRADIATED POLYETHYLENE. Kolesov, S. N.; Mesenzhnik, Ya. Z.; Balaban, N. P.; Kolesov, I. S.; Putintsev, V. A. (Tashkent Electro-Technical Inst.). Dokl. Akad. Nauk Uzb. SSR No. 2, 15-17(1975). (In Russian).

By thermal processing of cable insulation made from gamma (^{60}Co) irradiated polyethylene, the macrostructure of the polymer could be controlled due to electric properties imparted earlier. (tr-auth)

22939 INFLUENCE OF HIGH-ENERGY ELECTRON IRRADIATION ON THE 10.6 μm ABSORPTION OF MIXED KCl CRYSTALS. Magee, T. J.; Johnson, N.; Peng, J. (Stanford Research Inst., Menlo Park, CA). Phys. Status Solidi A.; 30: No. 1, 81-86(16 Jul 1975).

Polycrystalline potassium chloride crystals alloyed with either RbCl, KBr, or $EuCl_2$ were irradiated with 1 MeV electrons at a dose rate of approximately 3.3×10^5 R/s. Measurements of the 10.6 μm absorption coefficient after each exposure indicated that the radiation induced infrared absorption saturated rapidly as a function of increasing electron exposure time. Measurements of the visible and near-infrared absorption spectra indicated no positive correlation between F-absorption centers and increased infrared absorption at 10.6 μm. A definite correlation was found between the density of F-aggregate centers and the change in 10.6 μm absorption. In particular, it is found that the largest changes in 10.6 μm absorption can be associated with the presence of R-centers in the mixed crystals. (auth)

22940 EARLY STAGES OF IRRADIATION HARDENING OF LiF SINGLE CRYSTALS. Urusovskaya, A. A.; Knab, G. G. (Inst. of Crystallography, Moscow). Phys. Status Solidi A.; 30: No. 1, 59-70(16 Jul 1975).

By several spectral (absorption, thermoluminescence, thermoemission of exoelectrons, and EPR) and mechanical (indentation, measuring of stress relaxation rate, and velocity of individual dislocations) methods the nature of irradiation hardening in LiF:Mg on the early stages of irradiation was studied. It is stated that initial irradiation hardening (at doses $<10^4$ R) is due to interaction of the irradiation with impurity complexes. (auth)

22941 MAGNETOELECTRIC STUDIES OF MAGNETIC TRANSITIONS IN ANTIFERROMAGNETIC CRYSTALS. Holmes, L. M. (Bell Telephone Labs., Holmdel, NJ). Int. J. Magn.; 6: No. 2, 111-120(1974).

From symposium on magnetoelectric interaction phenomena in crystals; Seattle, WA (21 May 1973).

Recent experimental studies of anomalies in the magnetoelectric (ME) effect associated with the magnetic ordering transition and with spin-flop and metamagnetic behavior in antiferromagnets are reviewed. The materials discussed include Cr_2O_3, $DyPO_4$, $TbPO_4$, $DyAlO_3$, $TbAlO_3$, and $MnGeO_3$. Some new results are presented on $MnGeO_3$. The status of present theoretical understanding of the ME behavior is evaluated critically. Promising new directions for research are pointed out and the potentialities of the technique are assessed. (auth)

22942 RADIOMETRIC ESTIMATION OF THE SPECIFIC GRAVITY OF A COAL PRISM. Stuchlik, V.; Chvatal, I. Uhli; 22: No. 9, 371-374(Sep 1974). (In Czech).

Measurements using a Cs^{137} source have been made, first in the laboratory on prisms of size $4 \times 9 \times 14$cm, then in pilot coking-plant on prisms of $40 \times 87 \times 135$cm and finally on charges of loosely packed coal. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstracts 22079, 22966, 23632, 23633, 23955, and 24053.

22943 (UCRL-TM-4917) CONCEPTUAL DESIGN OF THE SPECIAL NUCLEAR MATERIAL NONDESTRUCTIVE ASSAY AND ACCOUNTABILITY SYSTEM FOR THE HTGR FUEL REFABRICATION PILOT PLANT. Jenkins, J. D.; McNeany, S. R.; Rushton, J. E. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 135p. Dep. NTIS $5.45.

The conceptual design of the fissile material assay and accountability system for the HTGR refabrication pilot plant has been established. The primary feature affecting the design is the high, time varying, gamma activity of the process material due to the unavoidable presence of uranium-232. This imposes stringent requirements for remote operation and remote maintainability of system components. At the same time, the remote operation lends itself to implementation of an automated data collection and processing system for real-time accountability. The high time-varying gamma activity of the material also precludes application of a number of techniques presently employed for light-water reactor fuel assay. The techniques selected for application in the refabrication facility are (1) active thermal neutron interrogation with fast-fission or delayed-neutron counting for fuel-rod and small-sample assay, (2) calorimetry for high-level waste assay, and (3) passive gamma scanning for low-level waste assay, and rapid on-line relative rod-loading measurements. The principal nondestructive assay subsystems are identified as (1) on-line devices for 100 percent product fuel rod assay and quality control, (2) a multipurpose device in the sample inspection laboratory for small-sample assay and secondary standards calibration, and (3) equipment for assay of high- and low-uranium content scrap and waste materials. A data processing system, which coordinates data from these subsystems with information from other process control sensors, is included to provide real-time material balance information. (auth)

22944 (SAND-75-0390) IRRADIATED FUEL BUNDLE COUNTER. Campbell, J. W.; Todd, J. L. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jul 1975. Contract AT(29-1)-789. 11p. (CONF-750608-13). Dep. NTIS $4.00.

From annual meeting of the Institute of Nuclear Materials Management; New Orleans, Louisiana, USA (18 Jun 1975).

The design of a prototype safeguards instrument for determining the number of irradiated fuel assemblies leaving an on-power refueled reactor is described. Design details include radiation detection techniques, data processing and display, unattended operation capabilities and data security methods. Development and operating history of the bundle counter is reported. (auth)

22945 PLUTONIUM, SAFEGUARDS, AND THE BREEDER. Conference Held at Knoxville, Tennessee, October 8–11, 1974. New York; Atomic Industrial Forum, Inc. (1975). vp. (CONF-7410119-). $20.00.

Nineteen presentations and statements are compiled on: Pu in the fuel cycle, safeguards (policies, regulations, industry, international, utilities, press, Congress), the LMFBR, plant security force duties (USAEC regulatory guide 5.43), radiation dose from inhaled Pu, Pu handling and hazards, and USAEC regulatory standards on transurantics. Separate abstracts were prepared for 18 of them. (DLC)

For abstracts of individual papers see: 22079, 22519, 22650, 22946–22956, 23632, 23633, 23955, and 24053.

22946 ARE CURRENT PRACTICES ADEQUATE. Taylor, T. B. pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

Events related to safeguards during the last year are reviewed. Present needs are a clear statement of safeguards objectives, more Federal funds, and design of facilities for easier safeguards. It is felt that effective safeguards can be implemented at relatively low overall cost to industry. C. Walske's presentation of the AIF position is strongly endorsed. (DLC)

22947 HTGR CYCLE AND SAFEGUARDS. Gioia, A. A. (General Atomic Co., San Diego, CA). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The HTGR is based on a highly enriched $^{235}U/Th/^{233}U$ cycle. The evolution of General Atomic Co.'s safeguards policy is described: it believes that while there are differences in safeguarding the several fuel cycles, the inherent risks and the accountability and protection means are essentially identical. Key points at which Pu, ^{235}U, and ^{233}U are vulnerable are outlined. It is felt that custodial protection for shipments of concentrated fuel forms should be the responsibility of government, and be paid for by the taxpayer. Furthermore, it is recommended that Federal storage facilities be made available for special nuclear materials. Plant security measures for the San Diego facility are described. Public information and acceptance are discussed briefly. (DLC)

22948 IMPORTANCE OF NUCLEAR SAFEGUARDS. Ray, D. L. (Atomic Energy Commission, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The AEC chairman discusses questions dealing with the transportation of nuclear materials and with some of the broader aspects of safeguards. The nature and the tremendous expansion of the shipments and the applicable AEC regulations for their protection are described. Accountability and AEC's inspection strategy are covered, and the response of AEC and other government agencies in case of incident is described. Spending and activities of the AEC safeguards program are outlined; safeguards at government-owned facilities will be upgraded. R and D in the safeguards field is described. (DLC)

22949 INTERNATIONAL SAFEGUARDS. Slawson, R. N. (Atomic Energy Commission, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

Safeguards relating to the transfer of nuclear materials and equipment exported from the U. S. to other countries and international organizations are discussed. Procedures and regulations are described, and some current developments affecting the evolution of safeguards and controls are mentioned. IAEA agreements and the non-proliferation treaty are discussed. Special attention is being given to critical areas in the fuel cycle. The Sept. 23 statement of Secretary of State Kissinger before UN is quoted. (DLC)

22950 LABORATORY PLUTONIUM: A PAPER TIGER. Wallis, L. R. (General Electric Co., San Jose, CA). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

To meet projected electrical energy consumption in 2070, the world will need nuclear power. Production of Pu and its use are discussed. Scare statements by nuclear energy critics are condemned. Experience in the safe handling of Pu at the GE Vallecitos Nuclear Center (VNC) is pointed out as showing that the Pu economy of the future can be approached with confidence. The health physics and safeguards program of VNC is included as an appendix. (DLC)

22951 NOTES ON CONGRESS AND NUCLEAR SAFEGUARDS. Donnelly, W. H. (Library of Congress, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

A brief history is given of nuclear technology and its export from the U. S., with emphasis on safeguards and the viewpoint of Congress. The impact of the Indian nuclear test and of the USA-Egyptian/Israeli and the France-Iran nuclear power commitments is reviewed. Congressional reactions are next discussed; its legislation for export control are described. The D. M. Rosenbaum report on safeguards and its impact on Congress are reviewed. The reorganization of AEC into ERDA and NRC and the position of safeguards are also touched upon. Nuclear indemnification (Price-Anderson amendment) is also considered. The Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in LWRs and the reactions of Congress and the NRDC to it are discussed. Finally, Government funding for safeguards is covered. (DLC)

22952 RESPONSIBILITY OF THE INDUSTRY AND THE PRESS. Lanouette, W. J. pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The roles of the nuclear industry and the press in the nuclear controversy field are discussed. It is pointed out that the press is the medium of both the terrorists and the nuclear industry. Information has two components: facts and interpretations; and it is important to keep them separate. The problem is illustrated by a specific news story. Suggestions are given on how the nuclear industry can best deal with the press: explain the special meaning of nuclear terms, avoid the "them" vs "us" syndrome, be honest and admit ignorance or bias, ask about deadline, do not be afraid to admit problems, etc. (DLC)

22953 SAFEGUARDS AND THE PUBLIC: THE UTILITIES' ROLE. Stetson, F. T. Jr. pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The utilities' role in public education concerning the safeguards against sabotage and diversion of special nuclear materials is discussed. Controversies, both past and future, are touched upon. The problem with the SNM diversion issue is how to obtain public confidence without compromising public safety. The tasks of the utilities are to get qualified PR personnel, to take the offensive, and to explain. (DLC)

22954 SAFEGUARDS: REGULATORY REQUIREMENTS. McWhinney, R. T. Jr. (Atomic Energy Commission, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The evolution of the AEC's safeguards regulations and its general philosophy and objectives are reviewed. The objectives are to protect against theft or diversion of nuclear materials, and against sabotage of nuclear power plants. Means for material protection at fixed sites and in transit, and for physical protection of power reactors and fuel cycle facilities are described. Actions underway are also discussed. (DLC)

22955 SAFEGUARDS: THE INDUSTRY'S ROLE AND VIEWS. Walske, C. (Atomic Industrial Forum, Inc., New York). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

Possible improvements in the U. S. safeguards system are discussed: guard forces, physical protection, personnel clearance, accounting and monitoring in plants, communications, the command function, reinforcements, and intelligence information. (DLC)

22956 STATEMENT OF LESTER ROGERS, DIRECTOR OF REGULATORY STANDARDS, U. S. ATOMIC ENERGY COMMISSION, PRESENTED AT EPA HEARINGS ON TRANSURANIUM ELEMENTS, December 10, 1974. Rogers, L. (Atomic Energy Commission, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

A summary is presented of some of the principal considerations given to limiting exposures to the public by the AEC as the Federal regulatory agency responsible for radiation protection standards in the nuclear industry. A bibliography of recent AEC regulatory issuances is included as Appendix A. Appendix B is also included which describes where Pu and other transuranium elements appear in the LWR fuel cycle, with and without Pu recycle, characterizes the transuranic plants, illustrates how the AEC regulatory process is being applied to these plants, and estimates the potential source terms. (DLC)

Disposal and Storage

Refer also to abstracts 22046, 22054, 22262, 22972, 22977, and 22979.

22957 (ARH-CD-133A) OPERATIONS DIVISION WASTE STATUS SUMMARY, JANUARY 1, 1974–MARCH 31, 1974. Anderson, J. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 31 Jul 1974. Contract AT(45-1)-2130. 12p. Dep. NTIS $4.00.

Tabular data are presented showing the status of the radioactive waste received, the amount stored in waste farms and the space available, summary of the tank farm storage, and the performance of the waste solidification system. (JSR)

22958 (ARH-CD-133B) OPERATIONS DIVISION WASTE STATUS SUMMARY. Progress Report, 1 April 1974–30 June 1974. Anderson, J. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 12 Aug 1974. 13p. Dep. NTIS $4.00.

Tables are presented showing the status of waste farms and tank farms and performance of the waste solidification system for the period April 1, 1974 through June 30, 1974. (LK)

22959 (ARH-CD-133D) PRODUCTION AND WASTE MANAGEMENT DIVISION WASTE STATUS SUMMARY, OCTOBER 1, 1974–DECEMBER 31, 1974. Anderson, J. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 30 Jan 1975. Contract AT(45-1)-2130. 12p. Dep. NTIS $4.00.

Tabular data are presented showing the status of the radioactive waste received, the amount stored in waste farms and the space available, summary of the tank farm storage, and the performance of the waste solidification system. (JSR)

22960 (ARH-SA-235) HYDROLOGIC MANAGEMENT AT THE HANFORD NUCLEAR WASTE FACILITY. Deju, R. A.; Gephart, R. E. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2130. 34p. (CONF-750667-1). Dep. NTIS $4.75.

From second international conference on environmental problems of the extractive industries; Dayton, Ohio, USA (15 Jun 1975).

Since 1944 the Hanford Reservation, located in south-central Washington, has been a site for radioactive waste storage and disposal. Many Hanford research programs are directed toward minimizing and managing the release of radionuclides into the environment. Hydrologic management of the Hanford facility involves such activities as regional and local geohydrologic characterization studies, environmental monitoring, groundwater management, and specific hydrologic research programs. This paper briefly examines each of these activities and reviews the progress to date in understanding the hydrologic flow regime existing beneath the Reservation. (auth)

22961 (BNWL-1639) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, DECEMBER 1971: DIVISION OF PRODUCTION AND HANFORD PLANT ASSISTANCE PROGRAMS. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1972. 25p. Dep. NTIS $4.25.

In radionuclide transport model studies an executive monitor program was developed which allows user keyboard control of all iterative sequence program functions. To continue the verification of sorption and transport models for the prediction of the movement of radionuclides in Hanford soils, the movement of ^{134}Cs was measured through a saturated tank farm sandy loam soil. Laboratory studies were initiated on the use of N,N'-methylene bisacrylamide for cross-linking sodium acrylate to form a stable ion exchange resin for possible use as grout to stabilized contaminated soils. Separation of Am from Pu in the Plutonium Reclamation Facility waste treatment system s–1 column was demonstrated in a mixer-settler using 0.1 M HNO_3 for the s–1 extractant. Americium was purified by dibutyl butyl phosphonate solvent extraction. (LK)

22962 (BNWL-1645) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, JANUARY 1972: DIVISION OF PRODUCTION AND HANFORD PLANT ASSISTANCE PROGRAMS. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Feb 1972. 31p. Dep. NTIS $4.75.

Activities are reported in the areas of environmental and regulatory technology, waste management, process technology, dosimetry technology, radiation standards and engineering, and radiation protection. (JSR)

22963 (CONF-741001-, pp 64-71) ANALYSIS OF OF CAVITY STABILITY BY THE FINITE ELEMENT METHOD. Anderson, C. A. (Los Alamos Scientific Lab., NM). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium proceedings. California Univ., Livermore (USA). Lawrence Livermore Lab.).

Long term steady state creep of underground structures is a problem of increasing importance by virtue of the implications to storage of radioactive waste materials and to energy extraction methods which employ underground structures or cavities. This paper describes the axisymmetric finite element code CSAAS which has been developed at the Los Alamos Scientific Laboratory in order to look at these problems. Special attention is directed to the "nearly incompressible" element formulation in CSAAS and

to the stable method of time stepping which is used to obtain an estimate of the incompressible steady creep state from an initial elastic solution. Applications are made to thermal creep problems involving pure halite which possesses a well documented creep law of the Weertman form; the flow rule for axisymmetric stress states is based on the Prandtl-Reuss law of metal plasticity. The resulting discretized equations are highly nonlinear. Comparison of the numerical results from CSAAS with the few known analytical solutions to one-dimensional steady creep problems indicates a high degree of accuracy for this finite element method. When applied to the examination of the long term stability of a spherical cavity in halite, various steady motions of the cavity can be observed, depending on the temperature field and the internal pressurization of the cavity. (auth)

22964 (EUR-5214e) LONG-TERM α-HAZARD OF HIGH ACTIVITY WASTE FROM NUCLEAR FUEL REPROCESSING. Girardi, F.; Bertozzi, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Dec 1974. 31p. Dep. NTIS (US Sales Only) $4.75. EUR B.Fr. 110,-.

The concentration and decay of α-emitters in high activity waste arising from spent nuclear fuel reprocessing was calculated under specified reference conditions. An attempt to evaluate the long-term hazard is being made by applying the "barrier" approach derived from reactor safety studies. Four barriers were identified, which could be evaluated in a probabilistic way by taking into account the great uncertainties present in each of them. The barriers are: (1) quality of the segregation afforded by deep geological formations, (2) stability of conditioned waste (chemical and physical), (3) retention by immediate surroundings, and (4) distribution pattern of actinides in the environment. Chemical separation of actinides from high activity waste would be an additional option of undoubted value for the disposal of high activity waste. An analysis of various levels of possible separations suggests that a reasonable target might be: Pu, Am, and Cm, decontamination factor 10^3; Np, coextraction with U and Pu with a 90% yield. (auth)

22965 (GSF-T-52) FINAL STORAGE OF RADIOACTIVE WASTE. Annual Report 1973. Albrecht, E.; Kolditz, H.; Thielemann, K.; Duerr, K.; Klarr, K.; Kuehn, K.; Staupendahl, G.; Uerpmann, E. P.; Bechthold, W.; Diefenbacher, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Wolfenbuettel (F. R. Germany). Inst. fuer Tieflagerung; Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Dekontaminationsbetriebe). Dec. 1974. 30p. (In German). (KFK-2105). INIS.

11 figs.

The present report – presented by the Gesellschaft fuer Strahlen- und Umweltforschung mbH, Muenchen in cooperation with the Gesellschaft fuer Kernforschung mbH, Karlsruhe – gives a survey of the 1973 work in the field of final storage of radioactive wastes. The mining and constructional work carried out aboveground and underground in the saline of Asse near Remlingen with a view to repair, maintenance and expansion for future tasks is discussed. Storage of slightly active wastes on the 750 m floor and the tentative storage of medium-activity wastes on the 490 m floor were continued in the time under review. In September, the multiple transport container S 7 V, developed in the GfK for transport of 7 200 l iron-hooped drums containing medium activity wastes, was employed in Asse for the first time. With two transports a week between Karlsruhe Nuclear Research Centre and the Asse mine, 14 drums were stored per week with a total of 233 drums at the end of the year. The report also gives information on the present state of research in the fields of mountain engineering geology and hydrology, and its results. In addition, new storage methods are mentioned which are still in the planning stage. (auth)

22966 PROBLEMS OF THE FUEL CYCLE. Finzi, S. (CCR–Euratom, Ispra, Italy). Energ. Nucl. (Milan); 22: No. 6, 326-336 (Jun 1975). (In Italian).

Updated information is presented on the research under way at Euratom JRC (Ispra) in the fields of the fissile material safeguards and the radioactive waste disposal. The former are concerned with the analysis of control systems of plants of different type, destructive and non-destructive analyses of fissile materials in irradiated and non-irradiated fuel elements, sealing, identification, and isotopic correlation. As for radioactive wastes, the Ispra programme is substantially focused on the management of actinides, produced by ^{238}U transmutations in reactor. The evaluation of "barriers" between highly active wastes and biosphere, the possibility of separating the actinides, and the study of an eventual possibility of "burning" the actinides in the reactor itself are the most relevant features of such a program. (auth)

22967 SEA DISPOSAL OF PACKAGED RADIOACTIVE WASTES. Olivier, J. P. (Nuclear Energy Agency, Paris (France)). pp 255-256 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Since 1967, the date of the first operation for the disposal of packaged radioactive wastes into the Atlantic Ocean under the control of the OECD, five further disposal operations have taken place in which various European countries have participated. The following topics are discussed: hazard assessment; selection of dumping areas; conditioning of wastes; selection of ships; costs; control of operations; and future prospects. (FR)

22968 SEALING METHOD FOR DISPOSABLE FILTERS CONTAMINATED BY RADIOACTIVE SUBSTANCES. Murata, F.; Kamiya, K. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1973-20360/B/. 20 Sep 1967. 3p. (In Japanese).

Filters used to clean the contaminated gases in nuclear reactors have come into wide use as a result of the proliferation of nuclear power generators. A method of hermetically sealing disposable filters contaminated by radioactive substances is described. The method consists of 1) sealing the gas flow, 2) introducing resin into a resin holder attached above the filter, 3) pouring the resin from the slit of the holder to cover the holes at the end of the filter, and 4) setting the resin to mold and enclose the filter. In this way, the present invention seals the filter by molding a thermosetting resin around it. (INIS)

22969 LEGAL ASPECTS OF RADIOACTIVE WASTE DISPOSAL. Pelzer, N. Energiewirtsch. Tagesfragen.; 25: No. 3, 102-105(Mar 1975). (In German).

In consideration of the increase of radioactive waste in the near future, deficiencies and shortcomings of nuclear energy licensing and control are pointed out in a review of the present legislation on radioactive waste disposal. The lack of definitions and of compulsory direct delivery or compulsory federal custody of radioactive waste are criticized. A clearly defined licensing procedure is also necessary for the disposal of spent nuclear fuels, which, according to the Atomic Energy Law, are subject to strict international control. Although some immediate improvements of the administrative regulations are possible, a comprehensive system for the disposal of radioactive wastes with adequate legal and organizational structures is deemed necessary for the future. (GE)

Handling Equipment and Procedures

Refer also to abstract 22981.

22970 (CONF-750930-1) PROPOSED MASTER-SLAVE AND AUTOMATED REMOTE HANDLING SYSTEM FOR HIGH-TEMPERATURE GAS-COOLED REACTOR FUEL REFABRICATION. Grundmann, J. G. (Oak Ridge National Lab., Tenn. (USA)). 1974. 18p. Dep. NTIS $4.00.

From 5th international symposium on industrial robots; Chicago, Illinois, USA (22 Sep 1975).

The Oak Ridge National Laboratory's Thorium-Uranium Recycle Facility (TURF) will be used to develop High-Temperature Gas-Cooled Reactor (HTGR) fuel recycle technology which can be applied to future HTGR commercial fuel recycling plants. To achieve recycle capabilities it is necessary to develop an effective material handling system to remotely transport equipment and materials and to perform maintenance tasks within a hot cell facility. The TURF facility includes hot cells which contain remote material handling equipment. To extend the capabilities of this equipment, the development of a master-slave manipulator and a 3D-TV system is necessary. Additional work entails the development of computer controls to provide: automatic execution of tasks, automatic traverse of material handling equipment, automatic 3D-TV camera sighting, and computer monitoring of in-cell equipment positions to prevent accidental collisions. A prototype system which will be used in the development of the above capabilities is presented. (auth)

22971 (DPSPU-75-30-5) SEPARATIONS CANYON DECONTAMINATION FACILITIES. Hershey, J. H. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Plant). May 1975. Contract AT(07-2)-1. 14p. (CONF-750822-1). Dep. NTIS $4.00.

From conference on decontamination and decommissioning of ERDA facilities; Idaho Falls, Idaho, USA (19 Aug 1975).

Highly radioactive process equipment is decontaminated at the Savannah River Plant in specially equipped areas of the separations canyon buildings so that direct mechanical repairs or alterations can be made. Using these facilities it is possible to decontaminate and repair equipment such as 10- x 11-ft storage tanks, 8- x 8-ft batch evaporator pots and columns, 40-in. Bird centrifuges, canyon pumps and agitators, and various canyon piping systems or "jumpers." For example, centrifuge or

evaporator pots can be decontaminated and rebuilt for about 60 percent of the 1974 replacement cost. The combined facilities can decontaminate and repair 6 to 10 pieces of major equipment per year. Decontamination time varies with type of equipment and radioactivity levels encountered. (auth)

22972 (UCID-16833) PROPOSED PRESSURE VESSEL CONCEPT AND DESIGN FOR TRITIUM GAS FOR OPERATION TO PRESSURES OF 68.95 MPa (680.5 ATM) AND TEMPERATURES TO 1000°C. Lakner, J. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Jul 1975. Contract W-7405-Eng-48. 42p. Dep. NTIS $5.25.

A proposed design for a pressure vessel to contain thermally hot tritium is described. It is a lined cylinder (4 in. id by 7.5 in. od by 17⅓ in. working depth) designed for operation to pressures of 68.95 MPa (680.5 atm) and to temperatures of 1000°C. Since these conditions do not allow for external heating, due to reduced strength of alloys and high gas-permeation rates at high pressures and temperatures, it is necessary to use internal heaters. In order to keep the amount of T_2 to a minimum for any particular experiment, it was decided to design a system where the T_2 would be contained in a small pressure vessel situated within a larger pressure vessel, with the internal pressure balanced externally with a non-radioactive gas. An additional advantage of such a system is that the specimen under T_2 does not "see" the heater environment and so contamination of the specimen is reduced. However, the converse is not true. The heater will "see" some T_2 due to diffusion through the inner container wall, the amount depending on pressure, temperature, and duration of the particular experiment. (auth)

22973 GLOVE BOXES AND SIMILAR CONTAINMENTS. US Patent 3,888,556. 4p.

According to the present invention a glove box or similar containment is provided with an exhaust system including a vortex amplifier venting into the system, the vortex amplifier also having its main inlet in fluid flow connection with the containment and a control inlet in fluid flow connection with the atmosphere outside the containment. (auth)

22974 CRITICAL EXPERIMENTS-BENCHMARKS (Pu-SYSTEMS). Bierman, S. R. (Battelle Pacific Northwest Labs., Richland, WA). Nucl. Technol.; 26: No. 3, 352-381(Jul 1975).

Fourteen different critical systems of plutonium-uranium homogeneous mixtures are arranged in a format amenable for use in validating calculational techniques and checking nuclear data. Each experimental system is completely defined under a single benchmark number. For the data that permit it, multiple critical dimensions are given for each fuel composition and geometry. Wherever possible, experimentally determined correction factors are provided for reducing the complexity of the critical assemblies. (auth)

22975 NOMINALLY REFLECTED PIPE INTERSECTIONS CONTAINING FISSILE SOLUTION. Dickinson, D. (Dow Chemicals, Golden, CO). Nucl. Technol.; 26: No. 3, 265-277(Jul 1975).

Monte Carlo calculations for pipe intersections containing highly enriched, concentrated uranyl nitrate solution and reflected by a concrete room provide safe pipe diameters for a range of room sizes. The pipe-wall material (steel, aluminum, or Plexiglas) has a small effect on k/sub eff/ for 0.125-in.-thick pipes. Replacing the uranyl nitrate solution by uranyl fluoride results in a large increase in k/sub eff/, and using plutonium nitrate (3 percent ^{240}Pu) lowers k/sub eff/. Reflector savings curves for water and for concrete around an infinite cylinder of uranyl nitrate solution show that thick concrete is a much better reflector than an equal thickness of water. The calculational data are summarized in the form of a table and a set of rules for the use of the table in the calculation of safe dimensions for a system of intersecting pipes. This method is also applicable to plutonium systems if the plutonium contains at least 3 wt percent ^{240}Pu and no ^{241}Pu. (auth)

22976 ROCKY FLATS EXPERIENCE WITH BOROSILICATE GLASS RINGS FOR CRITICALITY CONTROL. Schuske, C. L.; McCarthy, J. D. (Dow Chemicals, Golden, CO). Nucl. Technol.; 26: No. 3, 254-264(Jul 1975).

The large scale use of borosilicate glass raschig rings for the storage of plutonium nitrate and enriched uranyl nitrate solutions began at the Rocky Flats Plant (RFP) in 1959. Much has been learned since that date in the use of these rings. Some of the problems encountered with raschig rings are (a) corrosion of rings; (b) settling of the rings; (c) chipping and cracking which have led to pump and drainage problems; (d) silicious deposits on the rings in the storage of uranium solutions; (e) plutonium oxide sludge deposits on rings; and (f) the problem of completely filling conventional domed tanks. Solutions to most of these problems have been found; however, problems (a) and (e) are receiving additional attention at RFP. (auth)

Transportation

Refer also to abstract 22517.

22977 (BNWL-SA-5314) SAFETY ANALYSIS OF THE TRANSPORTATION OF HIGH-LEVEL RADIOACTIVE WASTE. Murphy, E. S.; Winegardner, W. K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 17p. (CONF-750607-26). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans Louisiana, USA (8 Jun 1975).

An analysis of the risk from transportation of solidified high-level waste is being performed at Battelle-Northwest as part of a comprehensive study of the management of high-level waste. The risk analysis study makes use of fault trees to identify failure events and to specify combinations of events which could result in breach of containment and a release of radioactive material to the environment. Contributions to risk analysis methodology which have been made in connection with this study include procedures for identification of dominant failure sequences, methods for quantifying the effects of probabilistic failure events, and computer code development. Preliminary analysis based on evaluation of the rail transportation fault tree indicates that the dominant failure sequences for transportation of solidified high-level waste will be those related to railroad accidents. Detailed evaluation of rail accident failure sequences is proceeding and is making use of the limited frequency-severity data which is available in the literature. (auth)

22978 (Y-DD-164) SAFETY ANALYSIS REPORT FOR PACKAGING (OAK RIDGE Y-12 PLANT MODEL 44 UNIRRADIATED FUEL ELEMENT PACKAGE). Dyer, H. R. (Oak Ridge Y-12 Plant, Tenn. (USA)). 29 Aug 1975. Contract W-7405-eng-26. 24p. Dep. NTIS $4.00.

An evaluation was made of the Y-12 Model 44 unirradiated Rover reactor fuel element shipping container to demonstrate its compliance with federal regulations governing the interstate transportation of fissile materials. Destructive testing and engineering evaluations were made to demonstrate the structural integrity and thermal resistance of the package in meeting the physical testing requirements described in the ERDA regulations. Reactor transport theory computer codes were used to analyze the criticality safety of the package. Results of this evaluation show that the package complies with all applicable regulations for Fissile Class I shipments of not more than 44 unirradiated Rover reactor fuel elements, with each package containing not more than 16 kg of uranium, enriched to 93 percent wt in the ^{235}U isotope. (auth)

22979 PLANS FOR SPENT FUEL MANAGEMENT IN CANADA. McLean, D. R.; Dyne, P. J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). B. C. Prof. Eng.; 26: No. 3, 30-33(Mar 1975).

Currently Canadian spent nuclear fuel is stored under water at the power plant where it is produced. Capacity is provided to accommodate spent fuel accumulated over a 30-year postulated life span of a CANDU nuclear power station. Canister storage as an alternative is being studied. Storage of wastes other than spent fuels will almost certainly take the form of burial in deep, stable geologic formations. Transportation is an important factor in a large country like Canada. (CA)

22980 PACKAGING FOR RADIOACTIVE MATERIALS IN FRANCE. Labrousse, M.; Remy, J.; Lucas, H. (CEA Direction des Productions, 92 - Chatillon (France). Sous-Direction du Plutonium). pp 235-237 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Research on radiological safety is presented: activity release, shock absorber calculation, practical studies on fire tests, use of sodium for the transport of FBR fuel elements and packaging decontamination. New packages were developed that are lighter and with a larger capacity. A package intended for the transport of Super Phenix fuel elements is studied. (FR)

22981 RADIOACTIVE TRANSPORTATION SAFETY. Now and in the Future. Sousselier, J.; Cohendy, G. (CEA Direction des Productions, 92 - Chatillon (France). Sous-Direction du Plutonium). pp 235 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

It may be already concluded that it is possible to guarantee that radioactive transportation safety will always be ensured in the future at a very high level. It would perhaps be useful to have more various type B packagings, and to increase the use of railways for these transports. (FR)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstract 22262.

22982 (BNL-20019) anti p AND anti n FACILITIES AT THE BNL AGS. Lowenstein, D. I. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 19p. (CONF-750547-3). Dep. NTIS $4.00.

From 4th international symposium on NN interactions; Syracuse, New York, USA (2 May 1975).

The typical AGS operating conditions are given, and the six antiproton beams and the one antineutron beam currently under test are described. Information on the following is given in tabular form: (1) the possible beam running configurations; (2) the status and availability of beams at the end of FY75; (3) a brief synopsis of the experiments that have gotten beam time during the present year; and (4) a description of new experiments which will use antiproton beams. (PMA)

22983 (BNL-20161) PROPOSAL FOR CONSTRUCTION OF A PROTON–PROTON STORAGE ACCELERATOR FACILITY (ISABELLE). (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1975. 87p. Dep. NTIS $7.50.

A proposal is made for the construction of proton storage rings at the Brookhaven Alternating Gradient Synchrotron (AGS) using superconducting magnets for which much of the technology has already been developed. This proton-proton colliding beam facility, "ISABELLE," will provide large increases in both the center-of-mass energy and the luminosity, key machine parameters for high energy physics. The physics potential and the general description of the facility are discussed in detail, and the physical plant layout, a cost estimate and schedule, and future options are given. (auth)

22984 (CONF-741001-, pp 149-156) COMPUTER UTILIZATION FOR DESIGN AND OPERATION OF THE SUPERHILAC. Selph, F. B.; Spence, D. A. (Univ. of California, Berkeley). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

The in-house constructed computer codes at the SuperHILAC can be divided into three main categories: (1) accelerator and component design; (2) control and operation; and (3) performance and diagnostics. The first category includes design programs of rf cavities, magnets, and beam optics. The second group contains programs for administration and logbook entries, machine parameter specifications, and openloop parameter control. Programs in the third category are those which directly or indirectly test the mechanical design and geometry of the machine, such as magnet testing, drift-tube-alignment, beam behavior and diagnostics. The present conversion of the SuperHILAC to computer control and a dual-ion time-sharing mode of operation is outlined in context with the complexities of operating this multi-ion, variable energy accelerator. Routines are discussed from the user's standpoint, covering such topics as on-line/off-line implementation, expected gain, actual results, and differences in characteristics which determine the method of computation. (auth)

22985 (CONF-741001-, pp 208-215) DRIFT TUBE ALIGNMENT AND BEAM EMITTANCE CODES IN USE AT THE SUPERHILAC. Spence, D. A. (Univ. of California, Berkeley). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Two Fortran-IV codes in use at the SuperHILAC are of significant value in optimizing the geometry of the accelerator and in evaluating the performance of the heavy ion beams. The first routine described is used to determine the existing root mean square deviation of the 210 internal drift tube quadrupoles fitted to a straight line or to a second-order quadratic. It then predicts the minimum number of drift tubes, and their identities, to be moved in order to attain a user-elected margin of error fit. Brief mention is made of the pulsed-wire alignment technique for the quadrupole positioning. The second program described is part of a data system which utilizes a PDP-8/I as a control device for the manipulation of beam-scanning hardware and a CDC-6600 in an offline interactive mode which gives the user maximum versatility in treating the raw data and displaying the results of calculations. The code portrays the transverse beam emittance figures and their transmission through the accelerator and transport lines. Also discussed are future plans which include on-line data reduction and CRT display by the PDP-8/I to enable the operators to optimize the tuning of the HILAC. (auth)

22986 (CONF-750824-1) OAK RIDGE ISOCHRONOUS CYCLOTRON AS AN ENERGY BOOSTER FOR A 25 MV TANDEM. Lord, R. S.; Hudson, E. D.; McNeilly, G. S. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

The maximum heavy-ion energy available at Oak Ridge will be substantially increased by using ORIC as an energy booster for the 25 MV "folded" tandem now being acquired. Beams of ions with mass up to A equals 160, with energy sufficient to overcome the Coulomb barrier on lead, will be produced. The beams will enter the cyclotron through the dee stem and will be directed by a magnet through the fringe and main fields to a stripping foil which lies on the appropriate orbit for acceleration. General orbit and beam transport codes were used to aid in the design of the injection system. (auth)

22987 MAGNETIC FIELD TRIMMING STUDIES FOR A SEPARATED-SECTOR CYCLOTRON. Hudson, E. D.; Martin, J. A.; Mallory, M. L.; McDaniel, F. E.; Irwin, F. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

Magnetic field studies were made for a four-sector, K equals 330 (E equals Kq^2/A MeV), separated-sector cyclotron using a $1/10$ scale model of a single sector equipped with 11 trimming coils. Data are presented showing the effects of saturation at high magnetic fields on the field contour and on the trimming coil characteristics. Some implications of these measurements for the design of separated-sector machine magnets are given. (auth)

22988 (CONF-750824-4) SEPARATED-SECTOR CYCLOTRON POST-ACCELERATOR FOR THE OAK RIDGE HEAVY ION LABORATORY. Mosko, S. W.; Hudson, E. D.; Lord, R. S.; Mallory, M. L.; Mann, J. E.; Martin, J. A.; McNeilly, G. S.; Ball, J. B.; Fischer, K. N.; Riedinger, L. L.; Robinson, R. L. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

A separated sector cyclotron post-accelerator is proposed for the Oak Ridge Heavy Ion Laboratory. The SSC accepts beams from either ORIC or the 25 MV tandem electrostatic accelerator and extends the maximum particle energy to 75 MeV/u for A less than 40 and to at least 10 MeV/u for A greater than 40. The SSC has a field-radius product of 2540 kG-cm, a 4-sector configuration, and azimuthal pole width of 52^0. RF acceleration of up to 1 MV per turn is obtained with two resonators in opposite valleys. An RF tuning range of 6 to 14 MHz accommodates acceleration on harmonics 2 through 11. Concentric second harmonic resonators are provided for optimizing phase acceptance. (auth)

22989 (LBL-3693) STATUS AND OUTLOOK FOR HEAVY-ION ACCELERATOR SYSTEMS. Grunder, H. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 5p. (CONF-750335-72). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

There are five major heavy-ion centers constructed or funded worldwide; two additional centers are on the verge of being funded. Additionally, there are numerous smaller installations producing excellent science. Most installations aim at 10 MeV/u for the higher mass particles, and as high as possible for lighter ions. Berkeley and Dubna have reached or plan to reach relativistic energies for heavy ions. Studies and proposals for additional relativistic heavy-ion facilities are pursued at least in five places. There is an obvious energy gap in proposed facilities, namely, 30 to 150 MeV/u for high-mass particles. Searches should be made for inexpensive magnets for high Bo in circular machines, or for very high, inexpensive electric gradients in linacs. This picture could be dramatically changed with a real breakthrough in ion source development. (auth)

22990 (NP-20444, pp 117-119) TEST RESULTS AND PERFORMANCES OF THE VAN DE GRAAFF MACHINE. Chatterjee, A.; Ganguly, A.; Ghosh, S. K.; Saha, A. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

22991 (ORNL-TM-4934) TANDEM ACCELERATORS, 1973–1974. Howard, F. T. (comp.). (Oak Ridge National Lab.,

Tenn. (USA)). 16 Dec 1974. Contract W-7405-eng-26. 76p. Dep. NTIS $7.00.

High voltage tandem accelerators are very important instruments in the field of nuclear physics research, especially in the acceleration of heavy ions. This survey identifies 77 tandems installed in 21 countries; of these, 34 are in the United States. Most installations have supplied data sheets identifying their machines and briefly characterizing their research programs. (auth)

22992 (TRI-PP-75-1) PRODUCTION OF SIMULTANEOUS, VARIABLE ENERGY BEAMS FROM THE TRIUMF CYCLOTRON. Richardson, J. R.; Blackmore, E. W.; Dutto, G.; Kost, C. J.; Mackenzie, G. H.; Craddock, M. K. (British Columbia Univ., Vancouver (Canada). Dept. of Physics). Mar 1975. 6p. (CONF-750335-66). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

An extracted beam at the design energy of 500 MeV was obtained at TRIUMF in December 1974. Later, beams of varying energies between 180 and 520 MeV were extracted down beam line 4, and further work resulted in the simultaneous extraction of a 506 MeV beam down beam line 1, while variable energy beams were brought down line 4. In order to reduce initial activation of cyclotron components, time average beams were restricted to 100 nA, but 12 mu A in a pulsed beam was very easily obtained at 500 MeV. Without much optimization of the injection conditions and without use of the harmonic trim coils, an energy spread (full width) of 2.5 to 3.0 MeV was observed. Ordinarily, the macro-duty factor was 100 percent and the micro duty factor corresponds to a 5 ns pulse every 44 ns. The transmission to 500 MeV is consistent with the expected loss due to gas stripping. (auth)

22993 AUTO-RESONANT ACCELERATION OF IONS. Drummond, W. E.; Sloan, M. L. (to Aralco). US Patent 3,887,832. 3 Jun 1975. Filed date 25 Jun 1973. 10p.

A method is described for accelerating ions utilizing a relativistic electron beam in a static, inhomogeneous magnetic field, in which the electron beam resonates in the cyclotron waveguide mode. Accelerating power is efficiently furnished to the driven ion particles by the electron beam through the intermediary of the cyclotron mode. (auth)

22994 ELECTRON-BEAM GENERATOR HAVING A LOW CHARACTERISTIC RESISTANCE OF THE IMPULSING CIRCUIT. Pavlovskii, A. I.; Kuleshov, G. D.; Gerasimov, A. I.; Tananakin, V. A. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1259-1262(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 20-23(1974).

In the impulsing circuit two ring-shaped storage devices, each consisting of 0.02-μF second ($\epsilon \approx 450$) K15-10 capacitors, are charged with opposite polarity to 100 kV and 35 μsec and are then connected to a diode with a field-emission plasma cathode by a controlled gas-filled spark gap situated in the cavity between storage devices along their axis. The scatter of spark gap turn-on is <10 nsec. The characteristic resistance of the impulsing circuit is 3.7 Ω. The constructions of the storage devices, the commutator, the diode, and the generator impulsing circuit which they form are presented. For a pulsed beam current of 15 kA having a duration of approximately 50 nsec (at the half-height) the electron energy is 160 keV at the instant corresponding to the current maximum. (auth)

22995 USE OF THE PPI MICROTRON IN PHOTONUCLEAR STUDIES. Abramov, A. I.; Ankin, G. N.; Vasin, V. T.; Klimtsov, N. A.; Stavisskii, Yu. Ya.; Filyaev, V. F.; Choporov, Yu. M. (Power Physics Inst., Obninsk, USSR). Instrum. Exp. Tech.; 17: No. 6, 1585-1587(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 35-37(1974).

Photoneutron reactions near threshold were examined by time-of-flight methods using the PPI microtron to provide current pulses shortened to 0.1 μsec with a repetition frequency raised to 2 kHz. The electron energy is reduced to the range from 11 to 14 MeV by transferring the electrons to an intermediate orbit, with the cavity displaced towards the center of the acceleration chamber. The magnetic field is varied to provide continuous energy adjustment. Techniques were developed for substantially increasing the working life of the cathode in this mode. (auth)

22996 SUPERCONDUCTING PION GENERATOR FOR CANCER THERAPY. Boyd, D. P.; Schwettman, H. A.; Li, G. C. (Stanford Univ., CA). pp 140-156 of Applications of Cryogenic Technology. Vol. 6. Booth, S. H. (ed.). Flushing, NY; Scholium International Inc. (1974).

From National Symposium and Exhibition on Applications of Cryogenic Technology; Los Angeles, CA (2 Oct 1973).

Recently, a number of measurements of the physical and radiobiological properties of the negative pion have confirmed the advantages of this particle for use in cancer therapy. An obstacle to the introduction of pions into clinical practice is the size and expense of the accelerator required to produce them. The development of a large solid-angle acceptance pion channel reduces the accelerator requirement, and use of a compact recirculated electron linac (500 MeV, 500 mu amp) becomes feasible. The basic magnetic elements of the channel are two 75° bend toroids, each consisting of 60 Nb-Ti wound superconducting pancake coils. The cylindrical design of the channel allows simultaneous multi-port irradiation with 60 controllable beams capable of depositing uniform biological equivalent dose distributions within an irregular-shaped deep-seated tumor. The installation of this system is nearly completed, and initial tests will be carried out at low intensity using the Stanford Mark III accelerator this fall. At a later date, when a high intensity beam becomes available from the recirculated superconducting accelerator, a quick switch will be made to this beam for pre-therapeutic studies. Construction of a prototype clinical pion facility in the Stanford Medical Center is planned, but is contingent on the successful completion of these tests. (auth)

Auxiliaries and Components

Refer also to abstract 22349.

22997 (BNL-20109) MODIFIED USE OF VAN DE MEER METHOD FOR LUMINOSITY DETERMINATION. Palmer, R. B. (Brookhaven National Lab., Upton, N. Y. (USA)). 7 May 1975. 6p. Dep. NTIS $4.00.

Modifications are suggested which should improve the accuracy of the Van de Meer method of determining beam luminosity at the CERN ISR. Four bending magnets would be inserted between the quadrupoles of a given experimental straight section, connected in series, and shimmed so that the machine parameters are not affected. The magnets would be driven with a zigzag current power supply with a uniform rate of current change. Experiments requiring accurate luminosity determination would be run while the deflection magnets are being driven with the oscillatory current pattern. (PMA)

22998 (BNL-20221) SMALLER QUADRUPOLES FOR ISABELLE. Parzen, G.; Jellett, K. (Brookhaven National Lab., Upton, N. Y. (USA)). 12 Jun 1975. 3p. Dep. NTIS $4.00.

Smaller quadrupoles are studied for use in the experimental insertions of ISABELLE. The reduction in size is obtained by reducing the maximum field gradient. A 40 kG/cm quadrupole will allow the distance between the two beams to go down to 22.8 cm. (auth)

22999 (BNL-20222) AGS CORRECTION QUADRUPOLES AND OCTUPOLES. Parzen, G.; Jellett, K. (Brookhaven National Lab., Upton, N. Y. (USA)). 6 Jun 1975. 8p. Dep. NTIS $4.00.

A pole-face design is presented for a set of correction quadrupoles and a set of correction octupoles required in the Brookhaven AGS. The pole-face design consists of a circular pole which is terminated by radial lines tangent to the circle. The radius of the circle is chosen to cause the lowest undesired multipole present to vanish. (auth)

23000 (CONF-741001-, pp 314-320) APPLICATION OF THE BRF SYSTEM TO SOME SUPERCONDUCTING MAGNET DESIGN PROBLEMS. Meuser, R. B. (Univ. of California, Berkeley). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

The Berkeley Remote Facility (BRF) system--affected through a system of teletype terminals linked to the LBL computers--was used to solve a large number of magnetic-field problems associated with the design and analysis of superconducting beam-transport magnets. The limitations of the BRF system are severe: total storage, 1000; 10 subscripted variables; no integer or complex arithmetic; no function or subroutine subprograms except those in its Spartan library; and a pidgin Fortran language. However, for fully 90 percent of the computational work, the low IQ of the BRF was more than counter-balanced by its being on-line. The magnets built have a long cylindrical aperture surrounded by arrays of longitudinal superconducting wires and iron arranged to produce a transverse field of prescribed shape, uniform fields for bending high energy charged particle beams, and quadrupole fields for focusing. The field in the aperture is expressed, usually, in terms of the coefficients of the Taylor's expansion--the "multipole coefficients." Point values of the field vector are also of interest, especially within the windings, as the magnitude of the field determines the allowable current. Many small programs were

developed to analyze both the two- and three-dimensional fields produced by various kinds of arrays of conductors. Some programs have the ability to vary a number of geometric parameters automatically in such a way as to drive the same number of multipole coefficients to zero. The on-line feature is especially handy, as such iterative calculations must often be cajoled into convergence. (auth)

23001 (CONF-741001-, pp 560) SCMAG SERIES OF PROGRAMS FOR CALCULATING SUPERCONDUCTING DIPOLE AND QUADRUPOLE MAGNETS. Green, M. A. (Univ. of California, Berkeley). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23-25, 1974. Symposium proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

A general description is given of four computer programs for calculating the characteristics of superconducting magnets used in the bending and focusing of high-energy particle beams. The programs are being used in the design of magnets for the LBL ESCAR (Experimental Superconducting Accelerator Ring) accelerator. (PMA)

23002 (CONF-750824-3) DESIGN STUDY FOR THE CONVERSION OF THE OAK RIDGE ISOCHRONOUS CYCLOTRON FROM AN ENERGY CONSTANT OF K EQUALS 90 TO K EQUALS 300 MeV. McNeilly, G. S.; Hudson, E. D.; Lord, R. S.; Mallory, M. L.; Mann, J. E.; Ball, J. B.; Martin, J. A. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep NTIS $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

A possible method of achieving a K equals 300 MeV cyclotron by increasing the average magnetic field of the Oak Ridge Isochronous Cyclotron (ORIC) from 18.6 to 33.9 kG with superconducting coils was investigated. (K is defined by the equation E/u equals $K(Q/A)^2$, where E/u is the energy per nucleon, Q is the ion charge, and A the atomic mass.) (auth)

23003 (HMI-B-154) PART 1. MATCHING OF THE VICKSI ACCELERATOR TO THE BEAM GUIDANCE SYSTEM. Part 2. Design of a Target Position with Perpendicular Beam. Hinterberger, F. (Hahn-Meitner-Institut fuer Kernforschung Berlin G. m. b. H. (F. R. Germany). Bereich Kern- und Strahlenphysik). Sep 1974. 142p. (In German). Dep. NTIS (US Sales Only) $10.25.

The problem of matching the Van De Graaff-Isochronous Cyclotron Combination for Heavy Ions (VICKSI) extracted beam onto the entrance slit of a monochromator system was studied under the special assumption of very restricted free space. Systems of 2, 3 and 4 quadrupole lenses are discussed, and the constraints which must be imposed upon the extracted beam phase space distribution are established in a general form. With respect to the target area with vertical incoming beam, two designs are proposed, which can be combined with the planned beam handling system. Both designs require the additional installation of only one 90° bending magnet. It is shown that the ion optic problem to focus the beam onto the target can be solved in a satisfactory manner. (auth)

23004 (JINR-P9-8753) MEASUREMENT AND SHAPING OF THE PULSED MAGNETIC FIELD IN THE ADGEZATOR MULTICHARGED ION ACCELERATOR. Aleksandrov, V. S.; Alekssakhin, Yu. I.; Barabash, L. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. (In Russian). Dep NTIS (US Sales Only) $4.25.

The installation for forming and shaping the pulsed magnetic field in the adgezator and for measuring its characteristics consists of four units: the pulsed power supply system, magnetic system, electronic control devices, and a complex of measuring instruments. A block diagram of the system is given and described. The results of the measurement of the pulsed magnetic field with a radius from 4 to 39 cm, with steps equal to 1 cm at time intervals of 10 μsec, are shown graphically and indicate the magnetic system is adequate for flattening the electron ring within the parameters desired. (JSR)

23005 (JINR-P9-8759) FEEDING SCHEMES FOR A COMPRESSOR MAGNETIC SYSTEM OF A HEAVY ION ACCELERATOR. Barabash, L. S.; Biiskii, S. M.; Golutvin, I. A.; Kiryushin, Yu. T.; Popov, A. A.; Sarantsev, V. P.; Timokhin, V. A.; Smolin, D. A.; Khabarov, V. S.; Chalyshev, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A system is described for shaping of the pulsed magnetic field in a compressor of a multiply charged ion accelerator. The feeding schemes are presented, as well as the results of temperature tests with the IM5-140 condensator. Switching, parameter measurement, and control of feeding system operation are performed by electronics operating with M-6000 on-line computer. (auth)

23006 (LA-tr-75-24) MEASURING THE MEAN VELOCITY OF CHARGED PARTICLES USING THE PHASE TRANSIT METHOD. Lomize, L. G.; Rubtsov, B. A.; Philipchikov, L. L.; Shmidt, A. V. Translated by A. D. Cernicek from Tr. Radiotekh. Inst.; No. 16, 274-286 (1974). 22p. Dep. NTIS $4.25.

A method is given for determining the mean velocity of accelerated bunched charged particles by measuring the phase difference between electromagnetic oscillations which are excited by a particle beam in two resonators separated by a flight length. It is shown that methodical errors of such measurements do not exceed hundredths of a percent. A block diagram of the measuring system is presented, as well as the first experimental results illustrating the efficiency of the measuring system. Ways to further increase the accuracy are discussed, which may amount to 10^{-3}-10^{-4}, using such a measuring method for narrow spectra. (auth)

23007 (LBL-3364) MULTI-WIRE CHAMBER SYSTEM FOR HEAVY ION BEAM MONITORING AT THE BEVALAC. Cuperus, J.; Morgado, R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 6p. (CONF-750335-26). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Horizontal and vertical integrated beam-current profiles are generated by a system of multi-wire chambers (32 wires/profile) operating in either the ionization or proportional mode. Sixteen distinct displays (1024 words) are digitally stored and any four may be simultaneously displayed. A new display can be generated at 64 ms intervals. A central control unit selects the mode of operation, the amount of delay after an appropriate trigger, the chamber integration time, and the particular chambers to be displayed. Operating in the proportional mode, the system can detect relativistic heavy-ion beam intensities as low as 10^4 charges cm^{-2} sec^{-1}. (auth)

23008 (LBL-3677) LARGE SUPERCONDUCTING SOLENOID FOR THE MINIMAG EXPERIMENT. Green, M. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1975. 25p. (CONF-750716-8). Dep. NTIS $4.25.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

The MINIMAG experiment detects and analyzes charged and neutral particles that result from the collisions of electrons and positrons in SPEAR II. The large superconducting solenoid, which detects charged particles, must be thin from a radiation standpoint. The radiation thickness of the solenoid and its cryogenic system were set at one-third of radiation length. As a result, the 1.5 T solenoid coil has a thickness of less than 2.0 mm. The superconductor must operate at a current density in excess of 8×10^8 A/m^2. The solenoid, which has a diameter of about 1 m, must operate at fairly high stress (3.3×10^8 N/m^2) in the conductor, while the magnetic stored energy is in excess of 0.7 MJ/m. The cryogenic and refrigeration system is rather unconventional because of the stringent radiation-thickness requirements of the experiment. The magnet, its cryostat, and its refrigeration system are described, and a series of experiments which lead to the full-scale magnet are also discussed. (auth)

23009 EXPERIMENTAL STUDY OF SPIRAL RESONATORS FOR ACCELERATION OF LOW VELOCITY IONS. Armstrong, D. D.; Bendt, P. J.; Erkkila, B. H.; Lunsford, J. S.; Shipley, J. P.; Stokes, R. H.; Sutton, J. (Los Alamos Scientific Lab., NM). Part. Accel.; 6: No. 3, 175-182 (Jun 1975).

The performance of copper spiral resonators, operating at room temperature, was studied for possible applications in the acceleration of heavy ions. Many resonator models containing one, two, or three axially spaced spiral structures were constructed and characterized at frequencies in the range 45 to 55, 80 to 84, and 99 to 106 MHz. Resonators with a variety of drift tube diameters have shunt impedance values in the range 30 to 74 megohms per meter. Six resonators have been tested at power levels of 10 to 20 kilowatts and accelerating fields up to 2.6 megavolts per meter. The 100 MHz power source used in the experiments and the feedback control for amplitude, phase, and frequency are described. Natural alpha particles were accelerated with a three-spiral resonator, and their energy gain was measured as a function of their detection time relative to the radio-frequency phase. The results of these tests show that spiral resonators have improved characteristics compared to short helix resonators of the same phase velocity. (auth)

23010 EXPERIMENTAL STUDY OF SUPERCONDUCTIVE NIOBIUM RESONATORS. Didenko, A. N.; Mel'nikov, M. V.;

Mednikov, B. A.; Petrov, N. N.; Samoy-Lenko, G. M.; Shiyan, V. P.; Yushkov, Yu. G. Tr. Nauchno-Issled. Inst. Yad. Fiz., Elektron. Avtom. Tomsk. Politekh. Inst.; No. 3, 43-45(1973). (In Russian).

Results are presented of initial measurements on superconductive niobium resonators in which saturation is achieved with respect to the Q and intensity of the magnetic and electric fields, this condition being especially important in accelerator engineering. The rated Q at the measurement temperature of 4.2°K was ~10^8. Cooling and holding at the necessary temperature were accomplished using a specially designed metal helium cryostat with intermediate cooling by liquid nitrogen. The superconductive resonator was suspended on three thin-wall tubes of stainless steel, two of which were used for the microwave signal input and output and one for evacuating the cavity. The Q, measured by the conventional method of the logarithmic decrement of microwave oscillations in the resonator, was 3×10^8. The considerable discrepancy between this value and the calculated Q can be explained by the fact that no other kind of machining was used to improve the surface finish of the resonator after turning on a lathe. (Referativnyi Zh.)

23011 WEDGE FILTER INTERLOCK SYSTEM FOR 4 MV LINEAR ACCELERATORS. Lane, R. G.; Doppke, K. P. (Univ. of Wisconsin, Madison). Radiology; 116: No. 2, 452(Aug 1975).

The wedge filter interlock system on a 4 MV linear accelerator was modified to ensure proper selection and placement of filter. By using a series of microswitches to replace the two-pin connection for each wedge, proper placement of the wedge in the treatment beam was ensured. Both the chain and plug were eliminated by using a 6 pole, 6 position sub-miniature rotary switch to produce the remaining connections. (auth)

23012 GENERALIZED CHARACTERISTICS OF THE OSCILLATORY SYSTEM OF A TUNED HIGH-VOLTAGE TRANSFORMER FOR SUPPLYING HIGH-CURRENT PULSED ACCELERATORS. Mezentsev, S. M.; Mikhailov, Naek, S. V. Instrum. Exp. Tech.; 17: No. 6, 1559-1562(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 14-17(1974).

Generalized characteristics are given for the coupled circuits of a tuned high-voltage transformer, and these can be used to calculate the circuit parameters for nonlinear loading, a condition typical of high-current pulsed electron accelerators. (auth)

23013 PULSE CIRCUIT FOR EXCITATION OF A PARTICLE ACCELERATOR ELECTROMAGNET. Lukonin, E. I.; Semenov, V. D.; Furman, E. G. (Tomsk State Univ., USSR). Instrum. Exp. Tech.; 17: No. 6, 1563-1564(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 17-19(1974).

A new method of betatron electromagnet excitation uses current pulses of quasitriangular form. The energy storing capacitor operates in a unipolar mode with respect to voltage, and the pulse repetition frequency is regulated. (auth)

23014 PLASMA ELECTRON SOURCE FOR AN ELECTROSTATIC ACCELERATOR. Vasil'ev, E. M.; Zinger, G. V.; Kreindel, Yu. E.; Ponomareva, L. P.; Ponomarev, V. P. (Tomsk Inst. of Automated Control Systems and Radioelectronics, USSR). Instrum. Exp. Tech.; 17: No. 6, 1569-1571(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 22-24(1974).

A cold-cathode electron source using a Penning discharge was developed for the EG-2.5 electrostatic accelerator. The current generated by the source reaches 2 mA at a gas flow rate of 3 cm^3/h and at a discharge power not exceeding 4 W. (auth)

23015 IMPROVED INJECTION EFFICIENCY IN GENERATING SHORT H- ION BUNCHES AT A LINEAR ACCELERATOR INPUT. Fedotov, A. P.; Kushin, V. V.; Rogachev, V. I. Instrum. Exp. Tech.; 17: No. 6, 1572-1573(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 24-26(1974).

Calculation results are given for a buncher for H^- ions at the input to a linear accelerator in a meson factory. The bunch length is 15 to 20 nsec, and the repetition frequency 10 MHz. The efficiency is improved by using a buncher operating at 10 MHz and a monochromator cavity at 30 MHz, the amplitudes of the effective voltages of these being approximately equal. The monochromator substantially reduces the length of the drift space and provides the required degree of energy uniformity in the bunch. The improved design provides up to 40% utilization of the injected particles, instead of the 15% available from HF designs. (auth)

Ion Sources and Injection and Extraction Systems

Refer also to abstract 22986.

23016 (BNL-20252) ISA INJECTION. van Steenbergen, A. (Brookhaven National Lab., Upton, N. Y. (USA)). 2 Jul 1975. 27p. Dep. NTIS $4.50.

The conceptual design of the ISA beam injection system is presented together with the relevant AGS-ISA beam transfer parameters. Steering onto the ISA injection orbit is done by means of a shutterless "split pole" vertical deflecting fast dipole. Consideration is given to the tolerable magnitude of the injection kicker stray field at the edge of the high density part of the beam stack. ISA aperture parameters are detailed and a maximum beam periphery profile ("dump profile") is defined within the aperture boundary of the superconducting ring magnet system. (auth)

23017 (HMI-B-165) BEAM MATCHING SYSTEM BETWEEN THE PREACCELERATOR AND MAIN ACCELERATOR FOR THE VAN DE GRAAFF–CYCLOTRON COMBINATION VICKSI. Hinderer, G. (Hahn-Meitner-Institut fuer Kernforschung Berlin G. m. b. H. (F. R. Germany). Bereich Kern- und Strahlenphysik). Jan 1975. 133p. (In German). Dep. NTIS (US Sales Only) $9.75.

The beam matching between the two accelerators of the heavy-ion accelerator combination Van de Graaff Isochron-Cyclotron Kombination für schwere Ionen (VICKSI) which is under construction at the Hahn-Meitner-Institut Berlin was investigated. The main elements are a combined gas- and carbon foil-stripper, used to increase the charge state of the ions, and two klystron-type high-frequency bunchers, used for matching the longitudinal phase space. In order to minimize the enlargement of phase space due to energy and angle straggling in the foil stripper, focusing in all three dimensions is done at this position. The system is comprised of two achromatic bending units, each consisting of two 45° magnets. The dispersion of the beam between the two magnets allows beam energy and phase width limiting. Half of the original dc beam is transformed into the acceptance of the cyclotron, except for stripper losses, using a third buncher in the terminal of the Van de Graaff. All ion optic calculations use the computer program TRANSPORT for the matrix formalism for the transformation of the six-dimensional phase and space. The proper positions of the stripper and the bunchers were determined analytically, and the specifications of the magnetic elements were calculated numerically. (auth)

23018 (LBL-3376) DESIGN OF THE ESCAR INJECTION BEAM LINE. Tanabe, J.; Staples, J.; Yourd, R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 12 Mar 1975. Contract W-7405-eng-48. 4p. (CONF-750335-71). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

The design features of the elements of the ESCAR (Experimental Superconducting Accelerator Ring) injection beam line are described. The junction of the proton transport system with the ESCAR injection straight section requires the design of mechanical elements compatible with the 10^{-11} torr vacuum requirements of the main ring. These elements include a novel septum magnet whose salient design features include a current-carrying septum of tapered thicknesses to reduce the overall power requirements and total enclosure of the magnet coil in a metal can for vacuum compatibility. Other elements are a wire electro-static septum and several fast-rise "bump magnets". A transition cryopump is designed to separate the main ring vacuum from the relatively poor 10^{-6} torr vacuum of the conventional beam transport line. A brief description of the conventional beam transport line from the 50 MeV proton linac, recently installed for Bevatron injection, is also included. (auth)

23019 SOURCE OF DOUBLY CHARGED HELIUM IONS FOR AN ELECTROSTATIC ACCELERATOR. Khirnyi, Yu. M.; Kochemasova, L. N. Instrum. Exp. Tech. (USSR). (Engl. Transl.); 17: No. 5, 1269-1271(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 28-30(1974).

The construction and characteristics of a He_3^{+2} source are described. For a very low discharge power (15 W) and a low gas discharge, the source produces an ion current of $He_3^{+2} \sim 0.7$ μA and has a long service life. (auth)

Ion Optics and Field Calculations

23020 (KFK-2105) EXPERIMENTS ON THE PRODUCTION OF RELATIVISTIC ELECTRON RINGS FOR THE COLLECTIVE ACCELERATION OF IONS. Krauth, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Mar 1975. 82p. (In German). Dep. NTIS (US Sales Only) $7.25.

Experiments on the production of dense relativistic electron

rings at the Karlsruhe ERA device are described. Starting with the possible performance characteristics of a collective ion accelerator using electron rings, the reasons for the choice of the experimental parameters are given. The parts of the experimental set up are described following the sequence of a compression cycle (injector, formation and compression of the ring). The beam parameters (current, dimensions) achieved in the different stages are given together with the limitations of the beam quality. Transient collective space charge effects during the formation of the electron ring, resulting in self inflection and beam degradation, proved to be the most severe limitations. Measurements with different geometries showed that longitudinal space charge forces are predominant. According to the deteriorating effects, the quality of the compressed rings was limited, but some experimental improvements are suggested. (auth)

23021 (LBL-2697) TRANSPORT: AN ION OPTIC PROGRAM, LBL Version. Paul, A. C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Feb 1975. Contract W-7405-ENG-48. vp. Dep. NTIS $7.60.

TRANSPORT is a computer code for calculating properties of charged particle beam transport systems using the matrix method in a six-dimensional phase space, and a version of TRANSPORT was translated into FORTRAN from the original BALGOL SLAC TRANSPORT. Many additional elements, options, and procedures were included and are explained, along with a standard TRANSPORT user's manual. Some of the important additions are polygon transformation, ray tracing, particle separator, space charge, output plotting, interactive on-line calculations, and flexible data manipulation procedures. (auth)

23022 (UCRL-50016-75-2, pp 22) LINAC BEAM-TRANSPORT VACUUM SYSTEM RELIABILITY. Lara, M. C. 1975.

In mechanical engineering department. Quarterly report: April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Although the 100-MeV electron–positron linear accelerator (Linac) is fairly typical of its kind, it has shown an exceptionally high degree of reliability and a correspondingly small amount of downtime. To a considerable extent, this good record is a result of the beam-transport vacuum system. The beam-transport vacuum system maintains a high vacuum of 10^{-4} to 10^{-5} Pa. It is compatible with the Linac 8 x 10^{-5} Pa vacuum system and has been designed to operate in an intense radiation environment. The overall performance of the beam-transport vacuum system through five years of operation has been extremely satisfactory. Of the seven original ion pumps installed, two have failed after 4.5 y of service and five are still in operation. None of the five has required rejuvenation. In those five years of service, downtime for the beam-transport vacuum system has averaged approximately 27 h/y. (TFD)

23023 CERTAIN MODIFICATIONS OF ELECTROMAGNETIC QUADRUPOLE LENSES. Samsonov, G. N. (Inst. of Scientific-Research of Electrophysical Equipment, Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1278-1280(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 35-36(1974).

Modifications of electromagnetic quadrupole lenses with a widened rectangular slot under the excitation winding are considered which allow operation over a wide range of variation of the gradient for a field nonlinearity of ≈1%. Compensation of the nonlinearity is ensured by choosing the pole profile and the shape of the winding. (auth)

23024 SPECTROMETRIC POSSIBILITIES OF A DOUBLET OF QUADRUPOLE LENSES. Breev, V. M.; Kats, M. M.; Mel'nikov, N. P.; P'yankov, A. P. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1281-1284(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 37-40(1974).

The possibility is considered of using doublet and triplet quadrupole lenses for the focusing and momentum analysis of a beam of high-energy particles. In the thin-lens approximation, formulas are derived for estimating the magnitude of the chromatic aberration of a doublet of quadrupole lenses which focuses a beam "from point to point". It is shown that in this case the chromatic aberration depends solely on the distance between the particle source and the analyzing collimator and on the particle-capture angle. Formulas are derived for estimates of the momentum resolution of the doublet. The results are checked on an electronic computer. (auth)

23025 IRONLESS MAGNETIC QUADRUPOLE LENS WITH CIRCULAR APERTURE. Skachkov, S. V. (Theoretical and Experimental Physics Inst., Moscow). Instrum. Exp. Tech.; 17: No. 6, 1581-1584(1974).

Translated from Prib. Tekh. Eksp.; No. 6, 32-35(1974).

The theory of an ironless magnetic quadrupole lens with a circular aperture is described. Formulas are presented for the design of such a lens, including a consideration of the winding thickness. (auth)

Storage Rings

23026 (DL/SRF/R-2) DESIGN STUDY FOR A DEDICATED SOURCE OF SYNCHROTRON RADIATION. (Science Research Council, Daresbury (UK). Daresbury Lab.). 1975. 113p. Dep. NTIS (US Sales Only) $8.75.

A detailed design study is presented for an electron storage ring facility to be used as a source of synchrotron radiation for experimental use. Topics covered include: (1) source requirements; (2) basic properties of synchrotron radiation; (3) a basic description of an electron storage ring; (4) design concepts of the proposed source; (5) the storage ring; (6) the booster synchrotron; (7) the injector and flight path; (8) the beam lines; (9) wiggler magnets; (10) the control system; (11) buildings and services; (12) estimates of cost, timescale, and manpower; and (13) a list of parameters. (PMA)

23027 (DL/SRF/R-3) SCIENTIFIC CASE FOR RESEARCH WITH SYNCHROTRON RADIATION. (Science Research Council, Daresbury (UK). Daresbury Lab.). 1975. 36p. Dep. NTIS (US Sales Only) $5.00.

An abbreviated and edited version of the report (produced in 1973) of the Panel set up by the Synchrotron Radiation Research Committee is presented. The plan which was based on the report was approved, and financial approval was given to construct a 2 GeV, 1 A storage ring at Daresbury Laboratory. Chapter titles and contents are: (1) introduction (including a section on the properties of synchrotron radiation); (2) the scientific case (studies in the solid-state, studies of atoms and molecules, studies of biological matter, and radiometry, using synchrotron radiation); and (3) radiation sources (including alternative sources of radiation, the existing facility at Daresbury, other synchrotron radiation sources in the UK, and other European sources). (UK)

23028 (RL-75-065) PRELIMINARY DESIGN OF A SUPERCONDUCTING WIGGLER MAGNET FOR THE DARESBURY LABORATORY SRS. Clee, P.; Cunliffe, N.; Simkin, J.; Trowbridge, C. W.; Watson, M. (Science Research Council, Chilton (UK). Rutherford Lab.). Dec 1974. 23p. (SRS-74/64). Dep. NTIS (US Sales Only) $4.25.

The results of a design study are reported for a three-pole superconducting Wiggler magnet which will be used to provide a local region of high magnetic field at one or more positions in the main ring of the proposed Daresbury Synchrotron Radiation Facility. The design is based on niobium-titanium composite superconductors, and the maximum field achievable under the imposed constraints with this material is shown to be on the order of 4.5 Tesla. The design constraints are given, along with information on the superconducting coils, the iron yoke, the cryogenics, the power supply, and a cost estimate. (PMA)

23029 (SLAC-Trans-169) USE OF SYNCHROTRON RADIATION FROM THE VEPP-3 STORAGE RING FOR X-RAY STRUCTURAL STUDIES. Mokul'skaya, T. D.; Moku'lskii, M. A.; Nikitin, A. A.; Anashin, V. V.; Kulipanov, G. N.; Lukashov, V. A.; Skrinskii, A. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Apr 1975. Translation of IAE-2385. 22p. Dep. NTIS $4.25.

Results are reported on the use of electron synchrotron radiation for x-ray diffraction studies of materials. The operating efficiency of all the components and the peculiarities of operating with the SR beam were ascertained. The beam intensity was compared to that obtained with fine-focus x-ray tubes operating at the characteristic radiation of copper. The apparatus for recording the diffraction patterns consisted of a monochromator, an x-ray camera, and a number of auxiliary devices. The diffraction patterns were photographed under different storage-ring operating regimes (electron energy from 1.6 to 2 GeV, current ranging from a fraction of a milliamp to 10 mA). Diffraction patterns for specimens of single crystal materials, metals, and fibrillar polymers were obtained on photographic film. (PMA)

Experimental Facilities

Refer also to abstracts 22308, 22370, 22417, and 23003.

23030 (ANL/HEP-CP-75-30) ANTIPROTON EXPERIMENT FACILITIES AT ARGONNE. Fields, T. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 6p. (CONF-750547-4). Dep. NTIS $4.00.

From 4th international symposium on antinucleon-nucleon interactions; Syracuse, New York, USA (2 May 1975).

A brief summary of the status of antiproton beams and related facilities at the Argonne Zero Gradient Synchrotron is given, including beams for counter experiments and beams for the 12-foot bubble chamber. A track sensitive target (TST) installation for the bubble chamber is described, and a list of presently approved antiproton bubble chamber experiments is given. (PMA)

23031 (BNL-19874) PRELIMINARY DESIGN OF A DEDICATED SYNCHROTRON RADIATION FACILITY. Chasman, R.; Green, G. K.; Rowe, E. M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 8p. (CONF-750335-65). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

An electron storage ring to be used solely as a synchrotron radiation source was designed for a maximum energy of 1.5 GeV, expandable to 2 GeV, and a maximum current of 1 A. High field superconducting magnet wigglers, serving as hard radiation ports, were incorporated into the ring to make available a wide range of wavelengths for simultaneous experiments. The regular lattice consists of a series of small achromatic bends forming the arcs. The wiggler magnets are placed in low-beta regions in the center of insertions separating these arcs. The arrangement minimizes the electron emittances and yields high source brightness. Other machine parameters are dictated by experimental requirements and apparatus as well as by cost constraints. (auth)

23032 (GSI-73-3) GSI WORKING CONFERENCE ON PARTICLE SPECTROMETERS, DARMSTADT, GERMANY, JANUARY 8–9, 1973. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Feb 1973. 134p. (In German). Dep. NTIS (US Sales Only) $9.75.

Ten papers were presented at the Conference. A separate abstract was prepared for each paper. (JSR)

For abstracts of individual papers see: 22370, 22420, and 23033–23040.

23033 (GSI-73-3, pp 1-5) CONSIDERATIONS ON A HF RECOIL SPECTROMETER FOR THE MUNICH ACCELERATION LABORATORY. Skorka, S.; Rudolph, K.; Hertel, J. (LMU-Munich). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

The recoil spectrometer planned for use in fusion experiments consists basically of a separator to separate the fusion products from the projectiles and a time-of-flight spectrometer to measure the fusion products. The separator consists of two quadrupole lenses and a hf Wien filter with a static magnetic field. The advantages of a hf filter in comparison with a static Wien filter and in comparison with a simple hf deflection are outlined. The principal design characteristics of the spectrometer are tabulated. (JSR)

23034 (GSI-73-3, pp 6-25) WORK IN THE YEAR 1972 ON THE DEVELOPMENT AND DETERMINATION OF THE PROPERTIES OF A HIGH-FREQUENCY SEPARATOR. Krueger, F. R.; Persson, B.; Kankeleit, E. (Technische Hochschule, Darmstadt, Ger.). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

The status of the initial development of resonators which can develop the necessary field strengths up to 100 kV/cm for the hf separator planned for the separation of heavy ions is described. The behavior of the geometrically axial ion beams in hf fields after passage through the target is evaluated. The ion optic treatment of the beam guide in the presence of the hf E fields is calculated. Calculations are made of the degree of separation that can be realized. The principles of the resonator are briefly reviewed. (JSR)

23035 (GSI-73-3, pp 26-36) BEAM PURIFIER AND TRANSIT TIME SPECTROMETER FOR REACTION PRODUCTS IN THE BEAM DIRECTION AT THE UNILAC. Huenges, E.; Vonach, H. (Technische Univ., Munich). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

A beam purification is proposed which should permit the observation of compound nuclei arising in reactions of heavy ions with targets of approximately equal mass number and emitted in the direction of the primary beam. The principal part of the system is a hf deflector in which the primary beam and reaction products are separated. Because of the imperfect time and energy structure of the primary beam, a pre-purification of the primary beam by hf deflection is proposed. A supplementary purification device consisting of a third hf deflector and an electrostatic repurifier is also suggested. Contamination with primary particles as a result of shield scattering was kept small by suitable dimensioning of the aperture shield. At the end of the system the secondary beam can be focused to about 20 mm ϕ. For the pre- and after-purification, two variations were proposed: in the first, a suppression of the primary beam by a factor of 10^8 appears possible, while in the second, an improvement of the suppression by at least an order of magnitude is possible at an intensity loss of the compound beam by a factor of 2. (tr-auth)

23036 (GSI-73-3, pp 37-48) VELOCITY FILTER FOR SEPARATION OF PROJECTILES AND REACTION PRODUCTS BEHIND THE TARGET OF THE HEAVY ION ACCELERATOR. Ewald, H.; Hinckel, P.; Muenzenberg, G.; Nickel, F.; Guettner, K.; Wollnik, H. (Univ., Giessen, Ger.). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

Three versions, similar in principle, of a system to free the reaction products from the primary beam behind the target are described. The first version consists of two Wien filters with symmetrically arranged separated fields and an achromatic focusing system composed of four homogeneous magnetic fields. The second version, instead of Wien filters, has deflection condensors operating at 500 kV behind the target and in front of the outlet slit. In the third version, two symmetrically arranged quadrupole doublets are used as focusing elements. The advantages and disadvantages of each are compared, and the engineering data for each are tabulated. (JSR)

23037 (GSI-73-3, pp 49-64) OVERVIEW OF THE PROPERTIES OF THE PARABOLA MASS SPECTROMETER "LOHENGRIN." Moll, E. (Institut Laue-Langevin, Grenoble, France). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

The optical parameters, measured image error, mass resolution capacity, the design of the deflection magnet and condenser, and the design of the proposed "Lohengrin" parabolic mass spectrometer are outlined using tables and graphs. (JSR)

23038 (GSI-73-3, pp 78-98) SEPARATION OF REACTION PRODUCTS FROM HEAVY ION REACTIONS. Project Proposal: Redundatron. Armbruster, P. (GSI, Darmstadt, Ger.). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

The specifications which a device must have for the separation of short-lived isotopes produced by heavy ion reactions are outlined, and the extent to which the ISOL system and the recoil spectrometer fulfill these conditions are discussed. The characteristics of kinematic mass separators, ($B\rho-F\rho$) spectrometers, ($\overline{B\rho}-v$) spectrometers, and separators without site separation are discussed and tabulated. On the basis of this discussion, a three-stage separator, in which the first stage is a kinematic separator, the second stage is a ($B\rho-F\rho$) separator or a gas-filled separator, and the third stage is a combination of transit time, energy, and specific ionization detectors, is proposed. The characteristics of this separator, the redundatron, are discussed. (JSR)

23039 (GSI-73-3, pp 99-110) VIEWPOINT FOR A HIGH-RESOLUTION MAGNET SPECTROMETER AT THE GSI. Puehlhofer, F. (Univ., Marburg, Ger.). Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

A proposal is presented for the construction of a high-resolving spectrometer based at the UNILAC, and the specifications of the device are given. The device would be used for analysis and identification of the reaction products from heavy ion induced nuclear reactions, especially for high-energy resolution and reaction angles different from 0°. (JSR)

23040 (GSI-73-3, pp 111-118) COMPARISON OF VARIOUS TYPES OF SPECTROGRAPHS WITH RESPECT TO HEAVY ION EXPERIMENTS. Martin, S. (Kernforschungsanlage, Juelich, Ger.); Wiedner, C. A. Feb 1973. (In German).

In GSI working conference on particle spectrometers, Darmstadt, Germany, January 8–9, 1973.

The characteristics of different spectrographs used in heavy ion experiments are discussed with respect to energy range, dispersion, magnification, vertical magnification, bending angle, mass-energy product, radius, solid angle, and resolving power. (JSR)

23041 (NP-20508) ANNUAL REPORT, 1974. (Tandemacceleratorlaboratoriet, Uppsala (Sweden)). Jan 1975. 88p. Dep. NTIS (US Sales Only) $7.50.

About 85 percent of the beam time for research during 1974 has been used for investigations in nuclear physics, covering a rather broad range of topics from research on the properties of few-particle systems and light nuclei, and, for instance, studies of the possibilities of coexistence of spherical and deformed states in medium-weight nuclei, to the measurements of cross sections for neutron-induced fission in heavy nuclei. Magnetic dipole and electric quadrupole nuclear moments have been determined by the

ion-implantation perturbed angular correlation and the reorientation precession techniques, respectively. Beam–foil spectroscopy has been carried out with oxygen and fluorine beams. Accelerator beams have further been used for analyses of surface composition and for nitrogen (protein) determination in seeds. The method for elemental analysis through particle-induced X-rays has been studied and combined with reaction techniques to make it useful for a wider range of elements. Details of these experiments are given, as well as information on the research instrumentation and data acquisition and handling systems. (auth)

For titles of selected individual papers see: 21825, 21826, 23384–23386, 23398, 23399, 23406, 23443–23448, 23459, and 23494.

23042 DETERMINATION OF THE COMPOSITION OF THE BEAM FROM THE MESON PATH OF A SYNCHROCYCLOTRON. Kuptsov, A. V.; Smirnov, G. I.; Khazins, D. M. (Joint Inst. of Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1275-1277(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 32-34(1974).

The relative content of pions in a beam containing pions, muons, and electrons was determined by comparison of the observed differential cross sections of the process of elastic π^-p scattering with the results of the simulation of this process. (auth)

23043 TWO-METER LIQUID-HYDROGEN TARGET WITHOUT LIQUID-NITROGEN COOLING FOR MUON EXPERIMENTS. Vasil'eV, L. M.; Dmitrevskii, Yu. P.; Mel'nik, Yu. M.; Prudkogiyad, A. F.; Sytnik, V. V. (Inst. of High-Energy Physics, Serpukhov, USSR). Instrum. Exp. Tech.; 17: No. 6, 1578–1580 (1974).

Translated from Prib. Tekh. Eksp.; No. 6, 30-32(1974).

A liquid-hydrogen target, having a liquid-H_2 working volume of 150 liters and a total volume of 250 liters, is described. The H_2 flow rate is 5 liters/day (liquid). The amount of material other than hydrogen in the beam path is ~5%, and the amount in the direction transverse to the beam is 2.75 g/cm^2. (auth)

23044 APPARATUS FOR MEASURING THE INTEGRAL CROSS SECTION FOR ELASTIC SCATTERING OF IONS AT A GAS TARGET. Chigin, V. I. Instrum. Exp. Tech.; 17: No. 6, 1588–1590 (1974).

Translated from Prib. Tekh. Eksp.; No. 6, 38–40(1974).

The scattering path length is increased by gas leakage through the chamber hole in measurements of elastic-scattering cross sections of gas targets. To compensate for this effect, the collector current is measured as a function of chamber length. Results are given on the integral collision cross section for Li ions and Ne atoms. (auth)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstracts 22398, 23092, 23120, 23171, 23197, and 23728.

23045 (JINR-P13-8359) DETERMINATION OF PREATMOSPHERIC DIMENSIONS OF MARJALAHTI METEORITE. Perelygin, V. P.; Viik, Sh. B.; Otgonsuren, O. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The track densities of nuclei of the Fe group and those with atomic numbers Z > 35 are measured in the olivine crystals from 54 points of the Marjalahti meteorite. It was found that Fe track density in this meteorite changes from 6×10^6 to 7×10^5 tr/cm^2, which change corresponds to depths from 4-5 to 10-12 cm from the cosmic surface of this meteorite. Losses in the meteorite mass when passing the dense atmospheric layers, according to the above measurements, are of about 90 kg, which constitutes 60% of the initial amount. (3 figures, 2 tables) (auth)

23046 (N-73-28753, pp vp Paper 1) DIFFUSE COSMIC X-RAYS BELOW 1 KEV. Kraushaar, W. L. (Univ. of Wisconsin, Madison). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A description of those features of the low energy diffuse x-ray flux on which there is general observational agreement is given. Most of the discussion is restricted to the energy region below 280 eV, the carbon K edge. Topics include intensity, spatial structure, nature of the local emission, and the extragalactic component. It is concluded that the diffuse soft x-ray measurements cannot, taken alone, be said to provide positive evidence for a hot dense intergalactic medium. (BJG)

23047 (N-73-28753, pp vp Paper 2) X-RAY EMISSIVITY OF THE UNIVERSE: 2--200 keV. Schwartz, D.; Gursky, H. (American Science and Engineering, Inc., Cambridge, MA). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Observational studies on the diffuse x-ray background between 2 and about 200 keV are discussed and presented in the form of the volume emissivity function. (BJG)

23048 (N-73-28753, pp vp Paper 3) MEASUREMENT AND INTERPRETATION OF THE COSMIC GAMMA-RAY SPECTRUM BETWEEN 0.3 AND 27 MEV AS OBTAINED DURING THE APOLLO MISSION. Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Data on the spectrum of the total (diffuse and discrete sources) cosmic gamma ray background over the 0.3 to 27 MeV range obtained during the trans-earth portion of the Apollo 15 mission is analyzed. Sources of interference in determining the magnitude and shape of the cosmic gamma spectrum are discussed. An upper limit measure of the gamma ray flux around 0.51 MeV is also obtained. (BJG)

23049 (N-73-28753, pp vp Paper 4) RECENT OBSERVATIONS OF COSMIC GAMMA RAYS FROM 10 MeV TO 1 GeV. Share, G. H. (Naval Research Lab., Washington, DC). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Recent observations of cosmic gamma rays made subsequent to the discovery of energetic photons from the galactic plane are presented. Three main areas under current investigation are discussed: gamma ray emission from the plane of the galaxy, gamma ray emission from the Crab Nebula and its pulsar, and diffuse gamma radiation. (BJG)

23050 (N-73-28753, pp vp Paper 5) REPORT TO THE GODDARD WORKSHOP ON GAMMA RAY ASTRONOMY RESULTS OBTAINED IN EUROPE SINCE THE IAU-SYMPOSIUM NO. 55. Pinkau, K. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The results on gamma ray measurements of the diffuse flux, and on the Crab pulsar NP 0532 are updated. (BJG)

23051 (N-73-28753, pp vp Paper 6) PRELIMINARY RESULTS ON SAS-II OBSERVATIONS OF greater than 30 MEV GAMMA RADIATION. Kniffen, D. A.; Fichtel, C. E.; Hartman, R. C. (Goddard Space Flight Center, Greenbelt, MD). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A description of the SAS-II detector, launched into orbit on November 15, 1972, is presented. Some of the preliminary results are reported. (BJG)

23052 (N-73-28753, pp vp Paper 7) OBSERVATIONS OF HIGH-ENERGY GAMMA RAYS. Fazio, G. G. (Smithsonian Astrophysical Observatory, Cambridge, MA). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The detection of high-energy gamma rays is achieved indirectly when the gamma rays strike the Earth's atmosphere, generating a shower of particles that in turn emit a burst of Cherenkov light. Ground-based detectors record the intensity and direction of either the particles or the Cherenkov light, or both, and hence determine the energy and arrival direction of the incident gamma-ray photon. Observations and results from such experiments are presented and future experiments are suggested. (BJG)

23053 (N-73-28753, pp vp Paper 9) ASTROPHYSICS OF THE DIFFUSE BACKGROUND OF X-RAYS AND GAMMA RAYS. Cowsik, R. (Univ. of California, Berkeley). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The origin of the diffuse x-ray and gamma ray background and some of the astrophysical implications of such a radiation background are discussed. The range of interest extends from 10^2 eV to 10^8 eV, over 6 decades, and into a variety of processes which contribute to the generation of a diffuse background. Angular distribution measurements are used in determining the distribution of the sources of the radiation background. (BJG)

23054 (N-73-28753, pp vp Paper 10) MECHANISMS FOR PRODUCTION OF THE DIFFUSE GAMMA-RAY CONTINUUM RADIATION. Stecker, F. W. (Goddard Space Flight Center, Greenbelt, MD). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The four processes involved in the production of the diffuse gamma ray continuum radiation are discussed: Compton interactions with low-energy photons, bremsstrahlung interactions, cosmic-ray induced π^0 production, and matter-antimatter annihilation. (BJG)

23055 (N-73-28753, pp vp Paper 11) GAMMA-RAY ASTRONOMY AND COSMIC-RAY ORIGIN THEORY. Ginzburg, V. L. (Lebedev Inst. of Physics, Moscow). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A theory of the origin of cosmic radiation is discussed in light of the advances made in gamma-ray astronomy. Arguments against metagalactic models for the origin of cosmic rays are emphasized. (BJG)

23056 (N-73-28753, pp vp Paper 12) PROSPECTS FOR NUCLEAR-GAMMA-RAY ASTRONOMY. Clayton, D. D. (Rice Univ., Houston, TX). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Gamma rays emitted as a form of nuclear deexcitation offer hope of another new astronomy. I consider such gamma rays coming from two sources outside the solar system: radioactive decay of fresh nuclear products of explosive nucleosynthesis, and scattering of low-energy cosmic rays. The former should be detectable and will provide a factual base for many suppositions about the site and history of nucleosynthesis. The latter may be detectable and, if so, will probably provide factual information about high-flux regions of cosmic radiation. (auth)

23057 (N-73-28753, pp vp Paper 13) ULTRA-HIGH ENERGY GAMMA-RAYS. Strong, A. W.; Wdowczyk, J.; Wolfendale, A. W. (Univ. of Durham, Eng.). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

An analysis is made of the interactions of very high energy cosmic ray protons with the relict radiation in extragalactic space. Two situations are examined: gamma rays derived from pi^0-mesons produced in collisions in a non-evolutionary situation and gamma rays from electron pairs produced at early epochs. It is shown that the ultrahigh energy gamma-rays (E/sub gamma/ greater than 10^{19} eV) could conceivably be of high enough intensity to be detected. The flux of gamma-rays from the second process (E/sub gamma/ less than 10^{9} eV) is not far from the diffuse background that has been reported. (auth)

23058 (N-74-28246) PROCEEDINGS OF THE WORKSHOP ON ELECTRON CONTAMINATION IN X-RAY ASTRONOMY EXPERIMENTS, 26 APRIL 1974. Holt, S. S. (ed.). (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). 1974. 168p. (CONF-740492-; NASA-TM-X-70673; X-661-74-130). Dep. NTIS $11.50.

From workshop on electron contamination in X-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

The proceedings of a conference to investigate the effects of extraterrestrial radiation and particle contamination of X-ray astronomical data are presented. The subjects discussed include the following: electrons at low altitudes which affect soft X-ray astronomy, the geographical distribution of 100 keV electrons above the earth's atmosphere, midlatitude electron precipitation, particle background observed by X-ray detectors on board Copernicus satellite, and a survey of trapped low energy electrons near the inner boundary of the inner radiation zone as determined by OSO-7. (auth)

For abstracts of individual papers see: 23093, and 23175–23184.

23059 ANALYSE EXTRATERRESTRISCHEN MATERIALS. (Analysis of Extraterrestrial Materials. Conference Held at Vienna, Austria, October 2–3, 1973). Kiesl, W.; Malissa, H. Jr. (eds.). Vienna; Springer-Verlag (1974). 334p. (CONF-7310107-). $22.90.

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973).

Fifteen papers are presented which deal with the study of extraterrestrial materials. (BJG)

For abstracts of individual papers see: 23060–23071, 23077, 23171, and 23172.

23060 RARE GAS STUDIES ON LUNAR PROBES. Wanke, H. (Max-Planck-Institut fuer Chemie, Mainz). pp 1-26 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German).

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

The various rare gas components are described which are of importance in the lunar samples. The concentrations of the rare gases derived from the solar wind are compared with the results of similar measurements on meteorites and with direct determinations of the solar wind composition. Radiogenic gas retention ages of lunar samples obtained with the $^{39}Ar/^{40}Ar$-method are discussed together with the results of age determinations based on other methods. Radiogenic ages and cosmic ray exposure ages give a time scale of the formation of some of the most important features of the lunar front side. An overall picture about the history of the formation of the lunar landscape is developed. (auth)

23061 HELIUM, NEON, AND ARGON IN SOME STONE METEORITES. Schultz, L.; Singer, P. (Eidgenoessische Technische Hochschule, Zurich). pp 27-36 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

Concentration and isotopic composition of He, Ne, and Ar have been measured in 15 chondrites. Six of these meteorites suffered diffusion losses of ^{3}He. The ^{21}Ne-exposure ages have been calculated with shielding-corrected production rates based on measured $^{22}Ne/^{21}Ne$ used as depth sensors. This procedure reduces the difference between ^{3}He- and ^{21}Ne-exposure ages significantly. (auth)

23062 SOLAR WIND NITROGEN IN LUNAR MATERIAL. Mueller, O. (Max-Planck-Institut fuer Kernphysik, Heidelberg). pp 53-64 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

Chemically bound nitrogen contents have been determined in various lunar samples from the Apollo 11 through Apollo 16 landing sites using the Kjeldahl method. This technique discriminates against molecular nitrogen, N_2, which may be a possible cause for contamination of lunar material by terrestrial atmospheric nitrogen. The results show that the main amount of nitrogen is present in a bound state. Nitrogen analyses on grain size fractions of fines have revealed that nitrogen is concentrated on grain surfaces and is derived most likely from the solar wind. Nitrogen can be used as a reference element in terms of solar elemental abundances, because it is chemically active and, therefore, is better retained in fine-grained lunar material than the lighter solar wind noble gases. Carbon to nitrogen atomic ratios of Apollo 14, 15 and 16 bulk fines are remarkably constant ranging from 1.35 to 1.75, and are interpreted as lower limits for the abundance ratio of these elements in the sun. (auth)

23063 COSMOCHEMISTRY OF ^{14}C. Boeckl, R. (Technische Hochschule, Darmstadt, Ger.). pp 75-83 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

Some applications of ^{14}C-analysis in cosmochemistry are discussed. Reported are a depth-profile of ^{14}C in surface-exposed lunar material, terrestrial ages of meteorite finds, and a maximum cosmic-ray exposure time for australites assuming the terrestrial age of 10^{4} years for these tectites. (auth)

23064 ISOTOPE EFFECT AND PARTICLE TRACKS IN LUNAR MATERIAL AND ITS RELATION TO THE RADIATION HISTORY OF THE MOON. Herpers, U.; Herr, W.; Kaiser, W. A.; Kulus, H.; Michel, R.; Thiel, K. (Univ., Cologne). pp 85-107 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

The role of the nuclide ^{53}Mn is studied with respect to the lunar cosmic ray exposure history of the Apollo 14 micro breccia 14305. Results of Re-isotope anomalies observed in both these lunar samples indicate a very complex neutron irradiation history. A simulated experiment is described where 150 kg of synthetical lunar soil was irradiated with 600 MeV protons. This experiment leads to a better understanding of interactions of cosmic particle rays with compact matter. (auth)

23065 SIGNIFICANCE OF TRACE ELEMENTS FOR COSMOCHEMISTRY. Kiesl, W. (Univ., Vienna). pp 109-123 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

A short review concerning the present position of cosmochemistry is given. The significance of trace elements as well as traces of organic compounds in extraterrestrial matter with respect to conclusions about cosmochemical events is shown by discussing some examples. (auth)

23066 MASS SPECTROMETRIC DETERMINATION OF TRACE ELEMENTS IN STONE METEORITES. Hintenberger, H.; Jochum, K. P.; Seufert, M. (Max-Planck-Institut fuer Chemie, Mainz). pp 125-145 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

In recent years a method for the determination of heavy trace elements from W to U in solids by means of sparc source mass spectrometry was developed. Sensitivity factors were determined using the Allende reference meteorite. Concentrations of siderophile elements W, Re, Os, Ir, Pt, and Au in ordinary- and carbonaceous chondrites are mutually correlated while Bi is anticorrelated to siderophile elements. Enstatite chondrites show somewhat different characteristics. The mass spectrometric determination of heavy trace elements may be used for classification of four Yamato meteorites. Each of these four stony meteorites can be assigned to a different class, that is E, Ah, C3 and H respectively. (auth)

23067 NON-DESTRUCTION DETERMINATION OF SOME TRACE ELEMENTS IN LUNAR AND METEORITE SAMPLES WITH 14 MeV NEUTRONS. Palme, H. (Max-Planck-Institut fuer Chemie, Mainz). pp 147-161 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

Meteoritic and lunar samples were irradiated 5 to 50 hours with a sealed 14 MeV neutron tube. The subsequent counting of the γ-active nuclei with a Ge(Li)-detector allows the determination of the abundances of some minor and trace elements. The concentrations of Mg and Al are used as internal standards. Elements which can be determined quantitatively in this way in most lunar samples (sample weights from 200-500 mg) are: Ca, Ti, Na, Sr, Zr, Y, Nb, Ce and Ni. The same method was applied to measure the abundance of Zr in the C1-chondrite Orgueil. The results of 4,1 ppm ± 10% is by a factor of about two lower than results of previous measurements. Fractionation of some refractory elements relative to C1-chondrites on the moon is discussed. (auth)

23068 NEUTRON-ACTIVATION DETERMINATION OF TRACE ELEMENTS IN METEORITES OF THE VATICAN COLLECTION. Hermann, F.; Wichtl, M. (Univ., Vienna). pp 163-172 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

The determination of 16 trace elements in 8 chondrites and 6 stony-iron meteorites was based on NAA and separation performed following a completed and perfected separation scheme. Together with results of other investigators they permit some conclusions on the origin of carbonaceous chondrites, stony-iron meteorites and enstatite chondrites. (auth)

23069 SEPARATION METHODS AND RADIOCHEMICAL DETERMINATION METHODS FOR SMALL AMOUNTS OF RARE EARTHS IN CHONDRITES. Becker, R. R.; Buchtela, K.; Grass, F.; Kittl, R.; Mueller, G. (Atominstitut der Osterreichischem Hochschulen, Vienna). pp 173-181 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German)

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

The application of neutron activation analysis of the rare earth elements in extraterrestrial matter is reported. Schemes for group separation and gammaspectrometric determination are described. This method is tested on the analysis of the Allende meteorite. It is possible to separate small amounts of rare earth elements by gas-chromatography of volatile chelates. The detection limits are improved by use of radioactive labelled chelates. All lanthanoides are rapidly separated by high voltage electrophoresis. Results obtained on 7 chondrites by this method are reported. (auth)

23070 ELEMENT CORRELATIONS AND THE CHEMICAL COMPOSITION OF THE MOON AND EARTH. Wanke, H. (Max-Planck-Institut fuer Chemie, Mainz). pp 183-201 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German).

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

During the work on chemical analysis of lunar samples it was observed that a number of elements occur in constant abundance ratios in spite of a variation of the absolute concentrations of up to three orders of magnitude. Most of these correlated elements have large ionic radii (LIL elements = Large Ion Lithophile elements). With the assumption that melting occurred down to the deep interior of the moon the observed element ratios should be valid for the whole moon. The correlated LIL elements are subdivided into two groups. The observed element ratios within each of both groups are identical to the corresponding solar ratios. A two component model for the moon is set up in which one component is a high temperature condensate similar to the one recently observed in the Allende meteorite, and the other component having chondritic abundances. The mixing ratio of the two components on the moon is calculated and the bulk composition of the moon is tabulated. The validity of the model is proved in two ways. (auth)

23071 ORGANIC MOLECULES IN INTERSTELLAR SPACE. Salpeter, E. W. (Specola Vaticana, Castel Gandolfo, Italy). pp 203-212 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German).

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

Discovery and detection of organic molecules in the intergalactic space by means of astro spectrographs and radio telescopes as well as conditions of formation and excitation of these molecules in dark clouds are discussed. (auth)

23072 HIGH-ENERGY COSMIC-RAY ELECTRONS IN NEAR-EARTH SPACE. Charakhch'yan, A. N.; Charakhch'yan, T. N. (Moscow State Univ.). Geomagn. Aeron. (Transl.).; 14: No. 5, 675-677(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 788-791(1974).

The results of stratospheric measurements of cosmic-ray showers show that the fluxes of electrons with $E \gtrsim 10^8$ eV are considerably smaller near the boundary of the atmosphere than those measured on satellites at a distance of 300 km from earth. The number of these electrons, N_-, is < 40 m^{-2} sec^{-1} ster^{-1} for the equator. (2 figs, 10 refs) (auth)

23073 CALCULATION OF FLUCTUATIONS OF CHERENKOV RADIATION OF ELECTRON-PROTON SHOWER. Uchaikin, V. V.; Lagutin, A. A. (Tomsk Polytechnic Inst., USSR). Yadern. Fiz.; 21: No. 6, 1257-1264(Jun 1975). (In Russian).

The fluctuations of the Cherenkov radiation and its correlation with the number of particles at the observation level are treated in the B cascade theory approximation. The numerical results for relative fluctuations and correlation coefficients for various observation levels are presented. (3 figures) (auth)

23074 INFRARED ASTRONOMY. Borgman, J. (Kapteyn Observatory, Roden, Netherlands). pp 188-208 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

This is a review paper on selected topics of infrared astronomy. After a discussion of problems arising in connection with the interpretation of observations a sort description is given of characteristic infrared features of stars, H II regions, planetary nebulae and extragalactic sources. A discussion of infrared observations of the galactic center leads to the tentative suggestion of a dense cluster of 3×10^6 late-type giants behind 200 magnitudes of visual extinction. (auth)

Stars

Refer also to abstracts 23149, 23162, and 23296.

23075 DIGITAL REDUCTION OF STELLAR SPECTRA. Turlo, Z.;. (Torun Uniwersytet, Poland). Stud. Soc. Sci. Torun., Sect. F; 5: No. 4, 9-23(1974).

A digital system for automatic reduction of stellar spectra recorded on photographic plates was constructed and tested. Hardware and software assembled for this purpose are described with some technical details relevant to the overall performance of the system. Results of the practical tests of this system are also included. (auth)

23076 INTERSTELLAR EXTINCTION AND SPECTROPHOTOMETRY OF THE HELIUM-RICH STAR HD 264111. Wegner, W. (Obserwatorium Astronomiczne, Torun, Poland). Stud. Soc. Sci. Torun., Sect. F; 5: No. 5, 7-28(1974).

23077 ELEMENT ABUNDANCE IN MAGNETIC STARS. Rakos, K. D. (Univ. Sternwarte, Vienna). pp 213-227 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German).

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

A discussion is given of various processes that may play roles in production of anomalous abundances of elements in peculiar A stars. Surface nuclear reactions on magnetic poles in the region of magnetohydrodynamical instabilities may be responsible for anomalous isotopic abundances of heavy elements. (auth)

23078 ZVEZDY: IKH ROZHDENIE, ZHISN', I SMERT'. (Stars: Their Creation, Life, and Death). Shklovskii, I. S. Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Fiziko-Matematicheskoi Literatury (1975). 367p.

Part 1 (birth of stars) covers the main observational characteristics of stars, general information on interstellar matter, cosmic masers and the evolution of protostars. Part 2 (stellar radiation) deals with mechanisms of stellar emission, nuclear energy sources, solar emission of neutrinos, white dwarfs, red giants, star models, and evolution of stars. Part 3 (star explosions) covers supernovae, x ray and radiowave emitters, and reasons why stars explode. Part 4 (death of stars) deals with neutron stars, pulsars as sources of radiowaves, and black holes. (SJR)

23079 INTERNAL STRUCTURE OF A POLYTROPE OF CONSTANT GRAVITATIONAL MASS DENSITY IN GENERAL RELATIVITY. Krori, K. D.; Barua, J. (Cotton Coll., Gauhati, India). Indian J. Phys.; 49: No. 1, 71-72(Jan 1975).

Comment is made on the solutions of Einstein's field equations for the internal structure of a polytrope of constant gravitational mass density in general relativity. (GHT)

23080 STARS AND THE MILKY WAY SYSTEM. Proceedings of the First European Astronomical Meeting, Athens, Greece, September 4–9, 1972. Volume 2. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974). 379p. (CONF-7209122-P2). $56.30.

Papers under the following topics were presented at this conference: variable stars, binary stars, space distribution and motions of the stars, interstellar matter, galactic center, chemical evolution of the galaxy, infrared astronomy, instruments, three-body problem, and galactic dynamics. (BJG)

For abstracts of individual papers see: 23074, 23081–23090, and 23149–23163.

23081 VARIABLE STARS AND STELLAR EVOLUTION (INVITED LECTURE). Kippenhahn, R. (Goettingen Univ., Observatory, Ger.). pp 1-16 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Observations of T Tauri stars are compared with theoretical models for stars surrounded by absorbing clouds and especially with recent computations of the formation of protostars. The problem of vibrational stability at the point where the instability strip crosses the main sequence is discussed as well as the possible influence of the direction of evolution on the properties of RR Lyr stars. Finally, models for R CrB stars are discussed and compared with observations. (auth)

23082 STABILITY OF THE LIGHT CURVES OF GALACTIC CEPHEIDS. Asteriadis, G.; Mavridis, L. N.; Tsioumis, A. (Univ. of Thessaloniki, Greece). pp 17-30 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

High accuracy photoelectric three-color (U, B, V) observations of the galactic cepheids CD Cyg; X, Z, RR Lac and U Vul have been carried out during the years 1967–1970 with the 38-cm reflector of the Hamburg Observatory installed at the Stephanion Observatory in Greece. A comparison of the results with the photoelectric two-color (B, V) observations of comparable accuracy of the same cepheids carried out in the years 1956–1959 with the 72-cm reflector of the Landessternwarte Heidelberg shows that no changes greater than the observational errors have occured in the form of the light and color curves of these cepheids between the two observational series. (auth)

23083 PULSATION AMPLITUDE OF CEPHEID VARIABLES. Nikolov, N.; Tsvetkov, T. (Univ. of Sofia). pp 31-35 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

On the basis of more numerous data a relation log $P\Delta V/\log\Delta R$ (P is the period, ΔR is the amplitude of the radius variation and ΔV is the amplitude of the V-magnitude variation) for cepheid variables has been established. A linear relation between log $P\Delta V$ and log ΔR for classical cepheids is found, which perhaps has a break at $\Delta R = 10\ R_\odot$. In the log ΔR/log P diagram the s-cepheids form a distinct sequence. All s-cepheids present a relative variation of the radii $\Delta R/R \leq 0.075$. Very probably this is in accordance with Efremov's (1968) hypothesis that these cepheids cross for the first time the instability region in the HR-diagram. On the basis of the log ΔR/log P diagram one could suppose that cepheids with log $P \geq 1.1$ pulsate in the first overtone whereas those with log $P \leq 1.1$ pulsate in the fundamental one. If these two groups of cepheids pulsate really differently, they would have a distinct P–L relation, as some investigators have found a break in the P–L relation of cepheids near log $P \approx 1$. (auth)

23084 INFLUENCE OF AN AXIAL ROTATION AND A TIDAL ACTION ON THE NON-RADIAL OSCILLATIONS OF A STAR, WITH REFERENCE TO THE β CANIS MAJORIS STARS. Denis, J.; Smeyers, P. (Univ. Louvain, Belgium). pp 36-38 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

The perturbation method has been further developed in order to study the influence of an axial rotation and a tidal action on the non-radial oscillations of a star. Results are obtained for the R-mode and the S-mode in the case of an homogeneous model and their implication for the interpretation of the beat phenomena observed in β Canis Majoris stars is discussed. (auth)

23085 ATLAS OF NOVA DELPHINI 1967. Seitter, W. (Observatorium Hoher List, Eifel, Ger.). pp 39-41 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

An atlas of objective prism spectra of Nova Delphini 1967 is being prepared at Bonn Observatory. Some of its major features are outlined with special emphasis on the wealth of information obtainable from objective prism spectrograms of novae if careful reduction methods are used. (auth)

23086 RADIUS–LUMINOSITY RELATION IN ECLIPSING BINARIES. Popovici, C.; Dumitrescu, A. (Bucharest Observatory). pp 53-59 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

The radius-luminosity relation in the form $M_b = x \log R + c$, is determined for main-sequence stars and subgiants in detached and semi-detached close binary systems. The $|x|$ value diminishes from $|x| = 12$ to $|x| = 6$ as we pass from the main-sequence stars to the subgiants. This is interpreted as an evolutionary effect and is compared with the evolutionary tracks by constant mass and by mass exchange. (auth)

23087 NARROW-BAND OBSERVATIONS OF SUPER-METAL-RICH STARS. Williams, P. M. (Inst. of Astronomy, Cambridge, Eng.). pp 174-177 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

The iron abundances of 300 evolved stars have been estimated from narrow-band photometry analyzed using synthetic spectra computed from model atmospheres. About 3% of the stars appear to have iron abundances significantly greater than that of the Hyades, and are regarded as SMR. Using the sodium and calcium abundances determined similarly, it is demonstrated that the apparent supermetallicity is not caused by the stars' having unusually large microturbulence or different $T(\tau)$ from normal stars. Some of the SMR stars appear from their space motions and evolutionary status to be old. (auth)

23088 FINE ANALYTIC ABUNDANCE DETERMINATION OF MAGELLANIC CLOUD A-SUPERGIANTS AND ITS IMPORTANCE FOR THE DISCRIMINATION OF THEORIES FOR THE CHEMICAL EVOLUTION OF THE GALAXY. Wolf, B. (European Southern Observatory, Santiago de Chile). pp 178-181 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Model atmosphere analyses have been done for the two brightest stars of the Magellanic Clouds: HD 33579 in the Large Magellanic Cloud and HD 7583 in the Small Magellanic Cloud. The results are presented and discussed in connection with the chemical evolution of the Galaxy. (auth)

23089 HIGH RESOLUTION ULTRAVIOLET STELLAR SPECTRA OBTAINED WITH THE ORBITING STELLAR SPECTROPHOTOMETER S 59. van der Hucht, K. A.; Lamers, H. J. (Astronomical Inst., Utrecht). pp 182-187 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

The experiment S 59 will observe the ultraviolet spectra of about 200 bright O, B, and A stars in three wavelength bands, 100 Å wide and centered around 2110 Å, 2540 Å and 2820 Å, with a spectral resolution of 1.8 Å. A study of the first obtained spectra has shown that: the Mg II resonance lines at 2800 Å in early-B stars are considerably stronger than was predicted by theory, the spectrum of γ^2 Velorum (WC8 + O8) shows a wide C IV emission line at 2530 Å, which indicates mass loss by the star, the interstellar lines of Mg^0, Mg^+, Fe^+ and Mn^+ in the spectrum of ζ Puppis (O4f) indicate that compared to hydrogen these elements are deficient by a factor 30 relative to the Sun. (auth)

23090 GRAVITATIONAL N-BODY PROBLEM FOR STAR CLUSTERS (INVITED LECTURE). Wielen, R. (Astronomisches Rechen-Institut, Heidelberg). pp 326-354 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Recent numerical studies on the gravitational N-body problem for small stellar systems containing up to 500 stars are summarized. The principal aims and fundamental problems of this experimental approach to the dynamical evolution of stellar systems are discussed. The properties of the investigated star cluster models are described and the general results of numerical N-body experiments are reviewed. A quantitative comparison between the experimental results and the predictions of statistical theories is carried out for the evolution of the density distribution and for escaping stars of isolated, spherical star clusters. The simulation of the dynamical evolution of open clusters, with special emphasis on the resulting total lifetimes, and of clusters of galaxies are discussed. (auth)

23091 ASTRONOMER'S VADEMECUM FOR PLASMA TURBULENT REACTORS. Norman, C. A.; Ter Haar, D. (Oxford Univ.). Fys. Tidsskr.; 72: No. 2-3, 84-90(1974).

It is shown how one can test whether an astronomical system with given luminosity and size, or given size and density, could possibly be a plasma turbulent reactor, and in what range of frequencies it can be expected to radiate. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 23050 and 23052.

23092 (N-73-28753) INTERNATIONAL SYMPOSIUM AND WORKSHOP ON GAMMA-RAY ASTROPHYSICS, GREENBELT, MARYLAND, 30 APRIL–2 MAY 1973. Invited Papers. Strecker, F. W.; Trombka, J. I. (eds.). (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Jun 1973. 447p. (CONF-730492-; NASA-TM-X-66279; X-641-73-180). NTIS $24.50.

Papers on the following topics are presented: diffuse cosmic x rays, x-ray emissivity of the universe, cosmic gamma radiation, gamma rays in solar flares, diffuse gamma-ray continuum radiation, the origin of cosmic radiation, nuclear gamma-ray line astronomy, matter-antimatter cosmology, a symmetric universe, and microwave blackbody background radiation. (BJG)

For abstracts of individual papers see: 23046–23057, 23095, and 23166–23170.

23093 (N-74-28246, pp vp, Paper 1) ELECTRONS AT LOW ALTITUDES: A DIFFICULT BACKGROUND PROBLEM FOR SOFT X-RAY ASTRONOMY. Seward, F. D.; Grader, R. J.; Torr, A.; Buginyon, G. A.; Hill, R. W. 24 Oct 1973.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Quasi-trapped and precipitating electrons have been observed with rocket-borne x-ray astronomy detectors in the altitude range 150 to 500 km. Because the flights occurred at low magnetic latitudes the electrons were unexpected. Data from many flights are combined to derive altitude dependence, an average electron spectrum, and variation with solar activity. Development of electron-rejecting collimators is discussed, and laboratory and flight data on these collimators are presented. (auth)

23094 HIGH-ENERGY GAMMA-RAY BURST FROM X-RAY SOURCE CYG X-3. Vladimirskii, B. M.; Stepanyan, A. A.; Fomin, V. P. Izv. Krym. Astrofiz. Observ.; 51: 3-7(1974). (In Russian).

The ground-based gamma-ray observations of the x-ray source Cyg X-3 by Cerenkov detectors of extensive air shower of the Crimean Astrophysical Observatory were made from 5 of September until 1 of November 1972. As the analysis of the data shows a gamma-ray burst in Cyg X-3 direction was observed on September 8–9. A counting rate excess was on 5 σ level. The flux value was $(2.0 \pm 0.4) \cdot 10^{-10}$ quanta $\cdot cm^{-2} \cdot sec^{-1}$ for the energy $\geq 10^{12}$ eV. An integral energy spectrum index is no less than 3.2 (auth)

Solar Phenomena

Refer also to abstracts 23173, 23203, and 23216.

23095 (N-73-28753, pp vp Paper 8) OBSERVATIONS OF GAMMA-RAY EMISSION IN SOLAR FLARES. Forrest, D. J.; Chupp, E. L.; Suri, A. N.; Reppin, C. (Univ. of New Hampshire, Durham). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

This paper reviews the observations of gamma-ray emission made from the OSO-7 satellite in connection with two solar flares in early August 1972. The details of the measurements and a preliminary interpretation of some of the observed features are given. (auth)

23096 (N-74-21440) HIGH ENERGY PHENOMENA ON THE SUN. A Symposium Held at Greenbelt, Maryland, September 28–30, 1972. Ramaty, R.; Stone, R. G. (eds.). (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). 1972. 640p. (NASA-TM-X-66290; CONF-7209126-). Dep. NTIS $5.75.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

Papers are presented under the following topics: flare theories and optical observations, microwave and hard X-ray observations, microwave and hard x-ray theories, ultraviolet and soft x-ray emission, nuclear reactions in flares, energetic particles from the sun, magnetic fields and particle storage, and radio emissions in the corona and interplanetary space. (BJG)

For abstracts of individual papers see: 23097–23143, and 23345.

23097 (N-74-21440, pp 3-11) MASS MOTION IN SOLAR FLARES. Sturrock, P. A. (Stanford Univ., CA). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Mass motions in solar flares are considered in terms of a previously proposed model. Particle acceleration occurs during reconnection of a current sheet located at coronal heights. The downward component of the particle flux produces an impulsive hard x-ray burst and heats the upper layers of the chromosphere sufficiently to lead to explosive evaporation. Some of the evaporated gas remains trapped in newly closed magnetic field lines and is responsible for the soft thermal component of x-ray emission. Gas which flows along open magnetic field lines subsequently forms a plasmoid which is ejected by magnetic stresses into interplanetary space and may subsequently cause a geomagnetic storm. Analysis of a highly simplified model leads to formulas for the density, temperature, and other parameters of the flare-produced plasma in terms of a length scale and mean magnetic field strength for the flare. (auth)

23098 (N-74-21440, pp 12-18) ENERGETIC PARTICLES AS A SOURCE OF FLARE ENERGY. Elliot, H. (Imperial Coll. of Science and Tech., London). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A solar flare model is presented wherein high energy protons stored in sunspot fields are the cause of flares rather than vice versa. Such particles could acquire their energy relatively slowly from the wave field associated with the active region. Some aspects of the model such as particle storage time in the magnetic field, release of the stored energy, and electron production are discussed. (BJG)

23099 (N-74-21440, pp 19-25) SOLAR FLARE OBSERVATIONS AND SOLAR FLARE MODELS. Hyder, C. L. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The strictly thermal infall-impact model cannot lead to temperatures greater than 5×10^8 K. At least one more process is needed to explain the high energy aspects of solar flares; that is, temperatures equal to or greater than 10^7 K, nonthermal x-ray and radio emissions, white light flares, high energy particles far from the sun, and gamma-ray-producing particles in the sun. (auth)

23100 (N-74-21440, pp 26-51) OPTICAL OBSERVATIONS OF THE AUGUST 1972 FLARES. Tanaka, K.; Zirin, H. (Hale Observatories, Pasadena, CA). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The optical appearance of the flares in McMath 11976 is described. The region showed complex, twisted magnetic fields from its birth on July 11, 1972. The flares occurred because of high field gradients and sheared field times, which made transitions to lower energy field configurations possible. Good H alpha spectra enables the measurement of the total H alpha flux as 2.5×10^{10} erg. In the 3835-A band, fast flashes of emission can be measured at the time of the impulsive flares, presumably due to dumping of energetic electrons in the chromosphere. In slower flares, the dumping is more gradual and occurs at the advancing front of the flare. The peak of emission in H alpha from the kernels and the peak 3835-A flashes agree very well with the hard x-ray peak. The spectra show H alpha emission 12 A wide in the flash phase of the August 7 flare. The observations agree well with a model in which the energy is released in a kernel with volume 2×10^{27} cm^3, diffuses outward to form a coronal cloud which gradually cools, and heats the chromosphere to produce the extended H alpha area. (auth)

23101 (N-74-21440, pp 55-77) CHARACTERISTICS OF NONTHERMAL ELECTRONS ACCELERATED DURING THE FLASH PHASE OF SMALL SOLAR FLARES. Kane, S. R. (Univ. of California, Berkeley). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Observations of impulsive hard x-rays and other flash phase emissions from small solar flares are analyzed in order to determine the characteristics of energetic electrons accelerated during the flash phase. The electron spectrum and its time variation are deduced from a model of the x-ray source in which the electron injection is continuous, and the electron energy loss is primarily due to collisions with the ambient plasma and escape into the corona. The instantaneous electron spectrum in the x-ray source, as well as the acceleration spectrum, are found to be nonthermal. The observations are consistent with a flare model having the following properties: The acceleration region is located in the lower corona where the ion density is less than or equal to 10^9 cm^{-3}. The total kinetic energy of the nonthermal electrons is approximately 10 percent of the total flare energy, so that the efficiency of the acceleration process is very high. The nonthermal electrons (and protons) provide energy for all flash phase emissions. The acceleration is a continuous process with a time constant less than or equal to 1 second, or a continuous series of impulses each lasting less than or equal to 4 seconds and a total duration of approximately 100 seconds. The electron spectrum continuously hardens during one increasing phase of the x-ray burst and softens during the decreasing phase. The more energetic flares do not necessarily produce a harder electron spectrum. (auth)

23102 (N-74-21440, pp 78-86) STRUCTURE OF PROTON CENTERS AND ASSOCIATED NONTHERMAL BURSTS AT MICROWAVE FREQUENCIES. Enome, S.; Tanaka, H. (Nagoya Univ., Japan). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

In the flaring region of the sun, a large variety of plasmas with various densities and a wide range of temperatures or energies is implied. These plasmas are heated and accelerated to subrelativistic and relativistic energies. Observational evidence is given on the characteristics of active regions which produced proton flares and on the structure of the associated nonthermal microwave bursts of the sun. The behavior of subrelativistic electrons on the sun is also described. Data are based on observations made with the Toyota interferometers at 3 and 8 cm, which have the same spatial resolution. (auth)

23103 (N-74-21440, pp 87-103) SPECTRAL CHARACTERISTICS OF MICROWAVE BURSTS. Guidice, D. A.; Castelli, J. P. (Air Force Cambridge Research Labs., Bedford, MA). 1972.

From proceedings on high energy phenomenon on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Various statistical parameters of the peak flux-density spectra of solar microwave bursts have been examined for 1968 to 1971 based on spectra obtained from fixed-frequency observations at 245, 506, 1415, 2695, 4995, 8800, 15400, and 35000 MHz made at the Sagamore Hill Radio Observatory, Hamilton, Mass. Even for gradual rise-and-fall bursts, often thought to be of thermal origin, less than 20 percent were found to have spectra which could be classified as thermal. The relationship between the burst spectral maximum (f/sub max/) and the photospheric magnetic field strength of the region associated with the burst was examined. A tendency for greater correlation at higher f/sub max/ for stronger magnetic fields is noted: however, this is overshadowed by the overall high correlations for those regions having strong photospheric magnetic fields. For bursts with cm components greater than 50 solar flux units (sfu), the relation between the low-frequency cutoff f/sub cut/ and the spectral maximum f/sub max/ was studied. It was found statistically that f/sub cut/ is well correlated with f/sub max/, with higher correlation for intensity 2 (50 to 500 sfu) bursts than for intensity 3 (greater than 500 sfu). For intensity 2 bursts, a good fit to the relation f/sub max/ equals Af/sub cut/ was found with A equals 3.4. (auth)

23104 (N-74-21440, pp 104-113) MILLIMETER WAVELENGTH OBSERVATIONS OF SOLAR ACTIVE REGIONS. Kundu, M. R. (Univ. of Maryland, College Park). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Polarization properties of active regions at 9 mm are discussed, and the observed degree of polarization is used to obtain an estimate of chromospheric magnetic fields. Also discussed is the polarization structure at 9 mm of an active region that produced a minor flare around 1900 UT on September 28, 1971. Total power observations indicate that new regions develop, or weak regions intensify at millimeter wavelengths as a result of bursts at distant sites. The spectra of the peak flux density of moderately strong bursts observed at 9 mm show a sharp drop toward the shorter millimeter wavelengths. The weak bursts at 3.5 mm are manifest mainly as heating phenomena. (auth)

23105 (N-74-21440, pp 114-123) SOLAR MILLIMETER-WAVE BURSTS. Croom, D. L. (Science Research Council, Slouth, Eng.). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

During the current solar cycle there has been a considerable increase in solar burst observations in the region above 10 GHz (wavelengths less than 3 cm). These observations have shown that many major solar events have large millimeter-wave components, and that the total burst radio energy is frequently concentrated in this part of the spectrum. (auth)

23106 (N-74-21440, pp 124-131) POSSIBLE LOW ENERGY (E less than 10 keV) NONTHERMAL X-RAY EVENTS. Kahler, S. W. (American Science and Engineering, Inc., Cambridge, MA). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A search of the 3- to 30-keV data from the NRL proportional counter detector on the Orbiting Geophysical Observatory-5 (OGO-5) satellite has yielded several events which may be nearly completely nonthermal in the 3 less than E less than 10 keV range. In each case an impulsive hard x-ray burst accompanied by an impulsive microwave burst was associated with a low energy

x-ray burst whose profile was a simple rise and fall. The lack of a two-component nature in the low energy range argues that the low energy x-ray flux is due to a single physical mechanism, in this case nonthermal bremsstrahlung from accelerated electrons. However, the spectra and time profiles are quite consistent with a thermal interpretation. Polarization measurements are probably necessary to resolve the physical origin of such bursts. (auth)

23107 (N-74-21440, pp 132-146) THERMAL AND NON-THERMAL X-RAY BURSTS OBSERVED FROM OSO-7. Peterson, L. E.; Datlowe, D. W.; McKenzie, D. L. (Univ. of California, San Diego). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The UCSD solar x-ray experiment on the OSO-7 observes x-rays in the 2 to 15 keV range with a proportional counter and in the 10.6 to 300 keV range with a scintillation counter. The dynamic range and instrument parameters are chosen to separate x-ray emission due to a hot thermal plasma from that due to nonthermal electron populations for a large number of x-ray events associated with small flares. Many different morphological classes have been observed in the 200 or so principal events observed between October 1971 and June 1972. For events which have both a thermal and nonthermal component, we can perform an analysis which shows that in not all events is it possible for the nonthermal electrons to energize the thermal plasma. We observe many events which have no nonthermal component, at least one event which was purely power law on initiation, and several events which had a long, slow decay of the hard x-rays. (auth)

23108 (N-74-21440, pp 147-161) OBSERVATION OF MeV GAMMA-RAY EVENTS DURING MAY 1967 FROM ERS-18. Gruber, D. E.; Peterson, L. E.; Vette, J. I. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

X- and gamma-ray fluxes are measured by the ERS-18 during the May 1967 MeV gamma-ray events. Observed counting rates are interpreted in terms of model spectra which are adjusted to fit the data. Emission models are also discussed. (BJG)

23109 (N-74-21440, pp 162-175) HIGH-ENERGY SOLAR X-RAY POLARIMETRY. Wolff, R. S. (Columbia Univ., New York). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The evidence, obtained by many workers, for the existence of a highly energetic nonthermal electron distribution in the solar atmosphere during energetic flares is reviewed. Relationships are discussed between the proposed x-ray emission processes, electron distribution, and possible x-ray polarization. A description of various techniques of measuring x-ray polarization is given, and the applicability of these methods to the problem of solar x-ray measurements is considered. An idealized polarimeter capable of obtaining the most useful data related to the energetics of solar flares is proposed, and current and projected polarization experiments are discussed. (auth)

23110 (N-74-21440, pp 179-187) THEORY OF MICROWAVE AND X-RAY EMISSION. Takakura, T. (Univ. of Tokyo). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Three problems concerning the behavior of nonthermal electrons created at the impulsive phase of flares are discussed: whether the emission sources of the microwave impulse burst and hard x-ray burst are common or not, whether the injection of the nonthermal electrons into the source is impulsive or continuous, and the relation among the nonthermal electrons, soft x-rays, euv flash, H alpha kernels, and white light flares. (BJG)

23111 (N-74-21440, pp 188-197) THEORY OF SOLAR MICROWAVE BURSTS. Ramaty, R. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The theory of solar microwave bursts is discussed in terms of gyrosynchrotron emission and absorption in a magnetoactive plasma and other absorption processes by the background medium. Simplified formulas for all turnover frequencies are given. Above about 2 GHz the most likely absorption processes for large bursts are free-free absorption and gyrosynchrotron self-absorption. The former process is capable of producing flux densities which are flat or slowly varying functions of frequency. The latter process sets absolute upper limits on the intensities of microwave bursts, which at a given frequency, depend only on the magnetic field in the source region. (auth)

23112 (N-74-21440, pp 207-220) NONTHERMAL X-RAYS AND RELATED PROCESSES. Hudson, H. S. (Univ. of California, San Diego). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The hard x-rays associated with solar flares represent the bremsstrahlung of nonthermal electron streams. In the initial phase of the flare, the x-rays probably come from a dense region in the chromosphere, as a consequence of precipitation from the lower corona. A gradual nonthermal x-ray burst may occur in a later phase, probably caused by the electrons responsible for the type IV burst. A picture of flare energetics is given. (auth)

23113 (N-74-21440, pp 221-227) OPTICAL, HARD X-RAY, AND MICROWAVE EMISSION DURING THE IMPULSIVE PHASE OF FLARES. Vorpahl, J. A. (Hale Observatories, Pasadena, CA). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A study was made of the variation in hard (E greater than or equal to 10 keV) x-radiation, H-alpha, and microwave emission during the impulsive phase of solar flares. Most important, the observations showed that there is an optical impulsive component in addition to the well-known hard x-ray and microwave spikes discussed by Kane and Anderson (1970). Properties of these H alpha kernels are given. Further analysis shows that the rise time in the 20- to 32-keV x-ray spike depends on the slope in the electron spectrum. E/sup -delta/ as t/sub rise/ equals 0.11 exp (0.87) delta when thick target theory is used. A picture of the impulsive phase is given that is consistent with observations of the three above emissions. (auth)

23114 (N-74-21440, pp 231-241) EXTREME ULTRAVIOLET SPECTRUM OF SOLAR FLARES. Noyes, R. W. (Harvard Coll. Observatory, Cambridge, MA). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

EUV flare observations are discussed, with particular attention to relative variations of spectra features during flares. An approximately equal enhancement of most chromospheric, transition-zone, and coronal lines indicates that thermal conduction may be important at temperatures between 10^5 and 10^6K in the flare plasma. However, enhancements sometimes appear to be somewhat larger for transition-zone lines and for density-sensitive lines arising from metastable levels. EUV lines characteristic of temperatures between 10^4 and 1.5×10^6K all show a nearly simultaneous rise in impulsive flares, coincident with the hard X-ray burst. Density increases by factors of 5 to 10 in the transition zone are inferred from emission-measure increases and from line ratios for small flares. (auth)

23115 (N-74-21440, pp 242-261) GROUND-BASED OBSERVATIONS OF EUV FLARE EMISSIONS. Donnelly, R. F. (NOAA Environmental Research Labs., Boulder, CO). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Ground-based observations have established that impulsive extreme-ultraviolet (EUV) flashes occur during solar flares, in close association with hard X-ray bursts and certain impulsive portions of the optical flare. The energy flux radiated in the 10 to 1030 A wavelength range exceeds that in hard X-rays (greater than or equal to 10 keV) by about 10^5, and is roughly comparable to the energy flux radiated at all optical wavelengths. In this paper our current knowledge of EUV flare radiation and ground-

based observations of the radiations are reviewed. Several hypotheses are proposed about the interrelation between impulsive EUV emissions and other flare radiations, their spatial location, and association with magnetic fields. (auth)

23116 (N-74-21440, pp 262-275) SOFT X-RAY FLARE SPECTRA. Doschek, G. A.; Meekins, J. F. (Naval Research Lab., Washington, DC). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The observed characteristics of X-ray flare spectra and spectroscopic diagnostics for determining electron temperature, electron densities, and departures from ionization equilibrium within the soft x-ray emitting plasma are discussed. Data have been obtained by three Bragg crystal spectrometers flown by the Naval Research Laboratory on OSO-6. (BJG)

23117 (N-74-21440, pp 276-282) FURTHER RESULTS ON COOLING MECHANISMS FOR SOFT X-RAY FLARES. Craig, I. J. D. (University Coll., London); Culhane, J. L.; Phillips, K. J. H.; Vesecky, J. F. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Two solar events with discontinuous temperature decays are analyzed. Temperatures and emission measures for both flares are derived. Cooling via radiation, conduction to chromospheric regions, and the collisional process are considered and three possibilities to explain the temperature decay are cited. (BJG)

23118 (N-74-21440, pp 285-300) SOLAR GAMMA RAY AND NEUTRON OBSERVATIONS. Chupp, E. L.; Forrest, D. J.; Suri, A. N. (Max Planck Institute for Physics and Astrophysics, Munich). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The present status of knowledge concerning the impulsive and the continuous emission of solar gamma rays and neutrons is reviewed in the light of the recent solar activity in early August 1972. The gamma ray spectrometer on Orbiting Solar Observatory-7 (OSO-7) has observed the sun continuously for most of the activity period except for occultation by the earth. In association with the 2B flare on August 4, 1972, and the 3B flare on August 7, 1972, the monitor provides evidence for solar gamma ray line emission in the energy range from 300 keV to 10 MeV. A summary of all the results available from preliminary analysis of the data will be given. Significant improvements in future experiments can be made with more sensitive instruments and more extensive time coverage of the sun. (auth)

23119 (N-74-21440, pp 317-340) SOLAR FLARE ACCELERATED ISOTOPES OF HYDROGEN AND HELIUM. Anglin, J. D.; Dietrich, W. F.; Simpson, J. A. (Univ. of Chicago). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

New measurements are reported of solar flare hydrogen, deuterium, tritium, helium-3, and helium-4 in the energy range approximately 10 to 50 MeV per nucleon obtained with University of Chicago instrumentation on the IMP-4 and IMP-5 satellites, and studies based on these results which place several constraints on theories of solar flare particle acceleration are discussed. A brief review of previous work and the difficulties in studying the rate isotopes of hydrogen and helium is also included. Particular emphasis is placed on the fact that the information to be obtained from the solar flare product of high energy interactions is not available through either solar wind observations where both the acceleration mechanism and the coronal source of the nuclear species are different, or optical measurements of solar active regions. The principal results are given. (auth)

23120 (N-74-21440, pp 341-354) ISOTOPES OF H AND HE IN SOLAR COSMIC RAYS. Garrard, T. L.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The isotopic composition of H and He in solar cosmic rays has been studied with the Ca. Tech. Solar and Galactic Cosmic Ray Experiment on the Orbiting Geophysical Observatory OGO-9. Averaging over 20 days of data from seven flare events during 1969, we find the ratios $^3He/^4He$ equals 0.10 +- 0.01, DH less than 3×10^{-4} and DH less than 1×10^{-4} in the 4 to 5 MeV/nucleon energy range. In addition, we find large variations in the relative abundance of ^3He from event to event, with a maximum ratio of $^3He/^4He$ equals 0.26 +- 0.08 observed during October 14-15, 1969. The relative abundance of ^3He and D during this event does not seem to be consistent with existing calculations of the nuclear interaction origin of these isotopes. (auth)

23121 (N-74-21440, pp 357-376) MAGNETIC FIELD RECONNECTION AND PARTICLE ACCELERATION. Sonnerup, B. U. O. (Dartmouth Coll., Hanover, NH). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

After a brief review of steady-state reconnection models, the processes are discussed which place an upper limit on the reconnection rate. In many applications the requirement that the width of the diffusion region exceed the ion gyroradius leads to a severe restriction on this limit. Unless the conductivity is much less than the value given by Spitzer's formula, solar flare times may result which are too long by a factor of 1000 or more. Turbulent and gyro effects which may lead to a reduced conductivity are shown to be operative, but only for sufficiently small ratios of plasma to magnetic pressure in the inflow. Particle energization processes associated with magnetic-field reconnection and particle reflection by fast shocks are considered briefly. These processes are effective as a first stage in the acceleration of charged particles, but additional multistep processes are needed to reach proton energies above a few MeV. (auth)

23122 (N-74-21440, pp 377-392) COMPOSITION AND ENERGY SPECTRA OF SOLAR PARTICLES. Price, P. B. (Univ. of California, Berkeley). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

An overview of "modern" and "ancient" energetic particles emitted in solar flares is given. Heavy ions (those with z greater than or equal to 2) emitted during solar flares are of particular interest. (BJG)

23123 (N-74-21440, pp 393-403) MECHANISM FOR THE ABUNDANCE ENHANCEMENTS OF HEAVY NUCLEI IN SOLAR FLARE PARTICLE EVENTS. Cartwright, B. G.; Mogro-Campero, A. (Univ. of Chicago). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A mechanism is proposed to account for the recently reported abundance enhancements of heavy nuclei in solar flares. The mechanism requires two acceleration stages for its operation: First, fully stripped ions are accelerated to suprathermal energies, and subsequently, a fraction of these ions are Fermi-accelerated to higher energies. It is shown that because injection into Fermi-acceleration is rigidity-dependent and the ions may pick up electrons during transport to the Fermi-acceleration region, an enhancement of the abundances of heavy nuclei can occur. The degree of the enhancement depends on a number of factors particular to each flare, so that the degree of enhancement may be variable from flare to flare, or may be a function of time within a given flare. In some flares, conditions may be such that no enhancement would be expected. (auth)

23124 (N-74-21440, pp 404-417) SOLAR COSMIC RAY MICRO-EVENTS. McDonald, F. B.; Van Hollebeke, M. A. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

To study small discrete solar particle events, it has proven useful to define a special class such that the proton flux at energies greater than 20 MeV exceed 10^{-4} protons/cm^2-sec-sr-MeV. These increases are termed micro-events. An arbitrary upper limit is placed at 2×10^{-2} protons/cm^2-sec-sr-MeV. By

demanding a measurable flux above 20 MeV, a better separation from corotating events is achieved and onset times can in general be determined more precisely. Over an observing period extending from May 1967 through December 1971, approximately 105 events were observed. There are several different sources of these small events. Some are produced by moderate to large solar flares near the east limb or by solar flares on the nonvisible disk of the sun. Others are produced by generally minor solar activity. A small sample of the micro-events can be classified as "scatter-free" events. For these the distance traveled by the particles before their initial detection at earth is on the order of 1.5 AU and observed rise and decay times are much less than normal. Examples of these general types of micro-events and their solar association are discussed. (auth)

23125 (N-74-21440, pp 418-426) MODULATION OF SOLAR COSMIC RAYS. Fisk, L. A. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

We consider whether the modulation of low energy solar cosmic ray nuclei between the sun and earth can be so extreme that the fluxes observed at 1 AU imply that the cosmic ray energy density in the solar atmosphere is comparable to the thermal energy density, and/or that the cosmic ray intensity is sufficient in the solar atmosphere to produce detectable fluxes of secondary particles such as low energy positrons. We find that such large modulation is compatible with observations, provided that we confine the modulation to occur principally within a solar envelope lying within approximately 0.2 to 0.3 AU of the sun. There is, however, no compelling observational evidence to require that the modulation is this large. (auth)

23126 (N-74-21440, pp 427-438) SOLAR FLARE ALPHA PARTICLES. Lanzerotti, L. J. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Interplanetary disturbances frequently change the instantaneous values of the low-energy solar flare alpha-to-proton flux ratios (when particles are compared as to equal energy per nucleon). The fluxes of alpha particles (approximately 1 to approximately 12 MeV/nucleon in five differential channels) have been integrated over the duration of seven large solar events occurring between May 28, 1967, and November 6, 1969, in order to investigate the total alpha particle fluxes observed at 1 AU resulting from the flares. The spectra of the event-integrated alphas are always softer than the spectra of the event-integrated protons. As a consequence, the event-integrated alpha-to-proton ratios decrease slightly with increasing energy per nucleon. The $^4He/^1H$ ratios averaged over the seven events are found to vary as $0.026\ (E/\text{nucl})^{-0.7}$ in the range 1 to 10 MeV/nucleon. The value of the ratio at 1 MeV/nucleon is less than the helium-to-hydrogen abundance determined from spectroscopic studies of prominences and the chromosphere (approximately 0.06), and is less than the average solar wind helium-to-hydrogen abundance (approximately 0.045). (auth)

23127 (N-74-21440, pp 439-449) RELATIONSHIP OF SOLAR FLARE ELECTRONS TO THE FLARE FLASH PHASE AND TYPE III RADIO BURSTS. Lin, R. P. (Univ. of California, Berkeley). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The energy spectrum and temporal behavior of the 10-100 keV solar flare electrons observed at 1 AU are interpreted in terms of: the location of the acceleration region; the time of acceleration and duration of the injection into the interplanetary medium; and type III radio burst origin at the sun and at 1 AU. For at least some and possibly the majority of electron flare events the density of the acceleration region is approximately $2 \times 10^9\ cm^{-3}$; the time of acceleration and release coincides to within minutes of the flash phase as indicated by the type III radio burst, and the duration of the release is less than or equal to 3 minutes. Evidence for the origin of type III radio bursts in 10-100 keV electron streams is shown and discussed. (auth)

23128 (N-74-21440, pp 453-477) CORONAL MAGNETIC FIELDS AND ENERGETIC PARTICLES. Newkirk, G. Jr. (National Center for Atmospheric Research, Boulder, CO). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The influence of the detailed configuration of the coronal magnetic fields below 2.5 R/sub solar mass/ on the characteristics of solar energetic particle emission is investigated. Particles are followed in the ambient magnetic field from their injection above a flare until they either impact on the photosphere, escape into interplanetary space, or mirror at some distant location in the corona. Calculations are applied to 46 flares of reported importance greater than 2^+ which occurred in the period 1959 to 1971. Possible differences in the ambient magnetic field configurations between proton and nonproton flares are examined. It is concluded that particle storage in high magnetic arches cannot account for the long duration (1 to 50 days) of particles with energies less than 10 MeV at 1 AU. Such particles must be generated by a continuously-operating acceleration mechanism. (BJG)

23129 (N-74-21440, pp 478-485) LOWER LIMIT TO THE ALTITUDE OF CORONAL PARTICLE STORAGE REGIONS DEDUCED FROM SOLAR PROTON ENERGY SPECTRA. Krimigis, S. M. (Johns Hopkins Univ., Baltimore). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The spectrum of low energy protons observed at 1 AU following solar flares shows little or no evidence of energy degradation down to approximately 0.3 MeV. Such observations may be used to set a lower limit on the altidue of hypothetical coronal particle storage regions, ranging from 2 to 7 R, (Krimigis and Verzanu, 1971; Verzanu and Krimigis, 1972). It is pointed out that closed coronal magnetic loop structures are observed to extend to less than 2 R, so that long term (greater than 1 day) storage of low energy protons does not take place in the immediate vicinity of the sun. It is further suggested that in the few cases where the proton spectrum appears to be degraded at low energies, the energy loss may be due to adiabatic deceleration in the expanding solar wind (Parker, 1965). The alternative of continual acceleration is suggested as a plausible substitute for the particle storage hypothesis. (auth)

23130 (N-74-21440, pp 486-502) CORONAL PROPAGATION OF ENERGETIC CHARGED PARTICLES. Roelof, E. C. (Univ. of New Hampshire, Durham). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A technique for estimating the equatorial connection longitude of interplanetary field lines to the corona is applied to quasi-stationary low-energy solar charged particle (LFSP) events to reconstruct their coronal injection profile. Comparison with synoptic charts constructed from H alpha chromospheric absorption features for solar rotation 1524 reveals that the inferred chromospheric equatorial magnetic neutral line structure strikingly orders the LFSP coronal injection profiles of greater than or equal to 0.3 MeV protons for this period (August 1967), allowing the identification of acceleration processes lasting several days and well-defined coronal transport over greater than or equal to 100^0. It is also proposed that LFSP observations offer a unique tool for studying the magnetic structure of the transition region from the low corona to interplanetary space. (auth)

23131 (N-74-21440, pp 503-515) ENERGETIC PARTICLE STORAGE ON THE SUN. Simnett, G. M. (Univ. of California, Riverside). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The observations of recurrence and long-lived events involving solar protons and electrons less than or equal to 30 MeV is discussed. Energetic and particle loss processes in the corona and energetic particles and solar radio observations are among the topics covered. (BJG)

23132 (N-74-21440, pp 519-536) SOLAR RADIO BURSTS AT KILOMETER WAVELENGTHS. Stone, R. G.; Fainberg, J. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The first section of this paper is a general survey of the characteristics of type III radio phenomena observed at hectometer and kilometer wavelengths. A brief discussion is also included here of the relationship between type I meter noise storms, decametric continuum, and type III hectometric storms. The second section deals with the analysis of type III bursts to show how these data provide information about the average energy, dispersion, and trajectory of energetic particles, as well as about the interplanetary density scale and magnetic field configuration. The third section is a brief description of the recent observations of type II shock wave phenomena at kilometer wavelengths. The summary outlines current research as well as the direction of future observations. (auth)

23133 (N-74-21440, pp 537-539) DECAY TIME OF TYPE III SOLAR BURSTS. Alvarez, H.; Haddock, F. T. (Univ. of Michigan, Ann Arbor). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Sixty-four Type III bursts that drifted to frequencies below 600 kHz between March 1968 and February 1970 were analyzed. Decay times were measured and combined with published data ranging up to about 200 MHz. By fitting power functions to the computed and observed decay times, and using the local plasma hypothesis, it was found that the ratio rho of computed to observed values varies with radiocentric radial distance according to a power function rho equals $3r^{0.7}$. (BJG)

23134 (N-74-21440, pp 540-551) DENSITY OF THE CORONA IN REGIONS OF TYPE III ACTIVITY. Kuiper, T. B. H. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Various determinations of the coronal density during solar radio bursts are made. It is suggested that type III bursts originate in coronal streamers. (BJG)

23135 (N-74-21440, pp 552-557) STORM OF TYPE III BURSTS OBSERVED BY RAE-1 IN AUGUST 1968. Howard, E. G. (Martin Marietta Corp., Denver, CO). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Curves of the number of type III bursts as a function of time are presented for six fixed frequencies (2.8, 1.65, 1.31, 0.995, 0.700, and 0.54 MHz). The curves peak at approximately 0500 UT August 20, 1968, and are symmetrical on both sides. Sakurai (1971) has shown that this time correlates well with the CMP of the McMath Region 9597. The maximum rate of bursts is approximately 150 per hour at the higher frequency of 2.8 MHz. Over 20,000 bursts were counted during the 15-day period from August 13 to August 27 when the active region was visible to the earth. A least-squares normal curve has been fitted to the observational data and calculations of variance and standard deviation are given. (auth)

23136 (N-74-21440, pp 558-572) TYPE II AND TYPE III BURST THEORY. Smith, D. F. (National Center for Atmospheric Research, Boulder, CO). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The present state of the theory of type III bursts is reviewed by dividing the problem into the exciting agency, radiation source, and propagation of radiation between the source and the observer. In-situ measurements indicate that the excitors are electron streams of energy about 40 keV which are continuously relaxing. An investigation of neutralization of an electron stream indicates that n/sub i/ less than or equal to 10^{-5} n/sub e/, where n/sub i/ is the stream density and the coronal electron density. In considering propagation to the observer, the results of scattering of radiation are discussed. It is concluded that the whole question of inferring densities from type III bursts needs to be reexamined taking into account dominant second harmonics near the limb at high frequencies, dominant second harmonics everywhere at low frequencies and scattering. The present state of the theory of type II bursts is reviewed in the same manner as type III bursts. The exciting agency is a collisionless shock wave. Radiation near the fundamental is relatively weaker than in type III bursts because it can be amplified less, and second harmonic radiation is stronger because of a more isotropic distribution of plasma waves. Apparently, backward radiation near the second harmonic may be dominant in some cases because of absorption of direct radiation in the shock. (auth)

23137 (N-74-21440, pp 573-576) TIME PROFILE OF TYPE III BURSTS IN DECAMETER AND HECTOMETER RANGE. Takakura, T. (Univ. of Tokyo); Naito, Y.; Ohki, K. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

It is hypothesized that the decay time of plasma waves is much shorter than the time scale of type III bursts especially at low frequencies. Accordingly, the time variation of radio flux at any given frequency merely corresponds to the fast electrons passing through the plasma layer. (BJG)

23138 (N-74-21440, pp 577-588) FLARE-INDUCED MHD DISTURBANCES IN THE CORONA--MORETON WAVES AND TYPE II SHOCKS. Uchida, Y. (Univ. of Tokyo). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aernautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The propagation in the corona of the magnetohydrodynamic (MHD) disturbance possibly emitted at the explosive stage in the initial phase of a flare is considered. The behavior of the MHD fast-mode wavefront, whose source is located at the flare, is calculated by using eiconal-characteristic method in the High Altitude Observatory (HAO) realistic models of coronal magnetic field and density for the days of some particular flare events. It is shown as the result that the peculiar behavior of Moreton's surface wave and the peculiar appearance in the shape and position of the type II burst sources can be consistently understood by considering the refraction, focussing, and fermation of shocks of MHD fast-mode disturbance in the actual distribution of Alfven velocity in the corona. Based on some comparison of the positions of low-Alfven-velocity regions in the corona with observed positions of type II burst sources, it is proposed that the type II burst sources may be identified with such low-Alfven-velocity regions "illuminated" by thus enhanced shocks. (auth)

23139 (N-74-21440, pp 589-593) REGULAR PULSATIONS FROM THE SOLAR CORONA. Wild, J. P. (CSIRO, Sydney). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The meterwave pulsations from the solor corona are discussed, including properties such as their dynamic spectrum, individual pulse shapes, and their pulse train. (BJG)

23140 (N-74-21440, pp 594-601) POSITION AND SIZE OF RADIO SOURCES ASSOCIATED WITH SOLAR ELECTRON EVENTS. Palmer, I. D. (Los Alamos Scientific Lab., NM); Lin, R. P. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The positions and sizes of the sources of type III bursts which are associated with interplanetary electron events (greater than 45 keV) are observed by the 80-MHz Culgeora radioheliograph. The sizes of the responsible electron streams at 0.6 R/sub solar mass/ in the corona are much smaller than the cones of propagation of the electrons in interplanetary space. Many of the type III bursts are shown to be accompanied by a type V continuum, and it is argued that the observation of a type III to V radio burst implies an increased spreading of electrons at heights greater than 0.6 R/sub solar mass/, consistent with the extent of the propagation cone of the electrons in interplanetary space. (auth)

23141 (N-74-21440, pp 602-609) HIGH SENSITIVITY SPECTRAL OBSERVATIONS IN THE DECAMETRIC RANGE. de la Noe, J.; Boischot, A.; Aubier, M. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Observations confirm the results derived previously from statistical studies, that decametric storms are associated with metric noise storms mainly constituted by type I bursts superimposed on

a broad band continuum. High sensitivity observation enables the study of this association in more detail, and in particular to conclude that in the decametric range there are two classes of type III bursts. (BJG)

23142 (N-74-21440, pp 610-614) HIGH RESOLUTION STUDY IN TIME, POSITION, INTENSITY, AND FREQUENCY OF A RADIO EVENT ON JANUARY 14, 1971. Caroubalos, C. (Observatoire de Paris, Meudon); Pick, M.; Rosenberg, H.; Slottje, C. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

High resolution position and spectrum measurements have been made of a complex solar radio activity on January 14, 1971, from 1120 to 1130 UT. Positions were measured with the 169 MHz Nancay B-W Radioheliograph, while dynamic spectra and polarization were observed with the 60-channel radiospectrograph of Nera. The radio event consisted of two closely similar groups of type III bursts and type II-like details, and a stationary type IV continuum, including some very clear pulsating structures. (auth)

23143 (N-74-21440, pp 615-622) CHROMOSPHERIC ASSOCIATION OF THE METRIC TYPE III BURSTS-IMPLICATIONS CONCERNING THE ACCELERATION OF SOLAR ELECTRONS AND THE ACTIVE STREAMERS. Axisa, F. (CEN, Saclay, France); Martres, M. J.; Pick, M.; Soru-Escaut, I. 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In High energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

In two recent papers we showed that the metric type III emission is closely related to a transient perturbation seen in absorption in the H alpha line. In addition, this perturbation sometimes triggers a flare, sometimes not. This can explain why the type IIIs have a poor H alpha flare correlation rate and still are a typical flash phase emission when flare-associated. Here we first summarize the characteristics of the new association proposed. We assume that 10 to 100 keV electrons are accelerated in connection with a particular kind of transient H alpha absorbing feature. For as yet undetermined reasons, this process would often, but not always, result in a more efficient acceleration coincident with the early phase of the optical flare. The probabilities that this process could lead occasionally to long lasting subrelativistic particle emissive region are explored. On the other hand, the region where the acceleration takes place is certainly connected to a coronal streamer, at least when a type III emission is observed. Consequently our observations indicate that a coronal streamer also exists above H_1 equals 0 lines which are not materialized by a stable filament. (auth)

23144 PROPAGATION OF ENERGETIC SOLAR PARTICLES IN CONICAL STREAMS. Roykhvarger, A. B. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 671-674(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 784-787(1974).

Expressions are obtained for the pressure and half-angle of a conical stream as functions of the velocity and half-angle of a shock wave. The region of the motion parameters where motion is possible and stability is found. The minimum average energy of particles in the stream is estimated. (4 figs) (auth)

23145 PC 2-4 PULSATIONS AND LOW-FREQUENCY OSCILLATIONS IN THE SOLAR WIND AHEAD OF A SHOCK-WAVE FRONT. Kovner, M. S. (Gorky State Univ., USSR). Geomagn. Aeron. (Transl.).; 14: No. 5, 725-728(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 850-854(1974).

The interaction of a flux of protons accelerated to E ~ 5 keV in the magnetosheath with the solar-wind plasma is investigated. The excitation conditions, increment, and frequencies of the generated oscillations are found. The investigation is limited to the propagation of the wind along the magnetic field. The results obtained are compared with experimental data. (14 refs) (auth)

23146 MOTION OF INTERPLANETARY GAS CAUSED BY A FLARE. Korobeinikov, V. P. pp 211-221 of Bogolyubov, N. N. (ed.). Moscow; Izdatel'stvo Nauka (1971). (In Russian)

Problems are considered in the propagation of shock waves in interplanetary space, which are caused by a chromospheric solar flare. Use is made of a gasodynamic approximation to describe the motion of the plasma. Four models are considered as characteristic of the source of perturbation of the plasma: explosion wave, piston, point explosion with subsequent motion of a piston and a model of a concentrated perturbation with supply of energy and mass. By assuming a frozen-in condition the configurations of the magnetic fields are found after passage of the shock wave from the solar flare. A number of theoretical results are compared with observed data on plasma parameters. (32 refs) (tr-SJR)

23147 NORTH-SOUTH-ASYMMETRIES IN SOLAR WIND AND SOLAR SPOTTEDNESS IN SUNSPOT CYCLE NO. 20. Hartmann, R. (Univ., Frankfurt am Main). J. Interdiscip. Cycle Res.; 6: No. 1, 41-46(Jan 1975).

Galaxies

Refer also to abstracts 23080 and 23088.

23148 THEORETICAL INTENSITIES OF LOW FREQUENCY RECOMBINATION LINES. Shaver, P. A. (Raman Research Inst., Bangalore, India). Pramana.; 5: No. 1, 1-28(Jul 1975).

The possibility of observable recombination lines below 200 MHz is shown to be greatest for the case of negative absorption in low-density gas in front of strong radio sources. The amplification of background radiation can conceivably exceed 100 percent, especially when the electron temperature is low; on the other hand, if the temperature is sufficiently high, dielectronic recombination may give rise to detectable recombination lines from elements other than hydrogen. The optimum frequencies are in the range 50 to 200 MHz for the interstellar medium, and 1 to 100 MHz for such intergalactic matter as may exist. The effects of external radiation fields, thermal and nonthermal, are explored quantitatively, and the relevant b_n factors are computed for a 1000-level atom; it is found that even the general galactic radiation field will significantly alter the atomic level populations. Observations of these masing low-frequency recombination lines would be useful in sorting out the hot and cold components of the interstellar medium, and in investigating their properties. (9 figures, 1 table) (auth)

23149 GOULD'S BELT. Lindblad, P. O. (Stockholm Observatory, Salts Jobaden, Sweden). pp 65-75 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Local properties of the Galaxy as related to the Gould Belt system of bright B stars are reviewed. In particular a first order model for the distribution of neutral hydrogen is described. (auth)

23150 CONCLUSIONS ON GALACTIC KINEMATICS FROM PROPER MOTIONS WITH RESPECT TO GALAXIES. Fricke, W. (Astronomisches Rechen-Institut, Heidelberg). pp 83-87 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

A comparison has been made between the results for precessional corrections and parameters of galactic rotation derived from fundamental proper motions and those measured with respect to galaxies at Lick and at Pulkovo. It is found that the results derived from the proper motions in declination are in fair agreement with each other. Since lunisolar precession and Oort's constant B follow mainly from μ_δ, it can be concluded that the fundamental system and the reference system of galaxies are identical within the range of errors of measurement. No hitherto undetected systematic motion of stars can be reliably deduced. The proper motions in right ascension measured at Lick and at Pulkovo differ from each other by more than one second of arc per century, and the fundamental μ_α lie very near to the mean of both. Although the total discrepancy cannot be explained at present, part of it appears to be due to systematic errors depending on the magnitude. (auth)

23151 MOLECULES AS PROBES OF THE INTERSTELLAR MATTER (INVITED LECTURE). Mezger, P. G. (Max-Planck-Institut fuer Radioastronomie, Bonn). pp 88-114 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

26 interstellar molecules have now been observed. Some of the observational problems pertaining to detection of molecules by radio spectroscopy are discussed in section II. Our present knowledge concerning the interstellar matter, especially with regard to its cloud structure, is reviewed in section III. The observational results pertaining to the formation of stars from the interstellar gas are discussed in Section IV. Sections V and VI present some examples of how molecules can be used as probes of the physical state of dense and cool interstellar

clouds, and, possibly, of the UV radiation within these clouds. Use of molecules to study the large-scale structure of the Galaxy, especially the inner nuclear disk, is discussed in Section VII. (auth)

23152 MOLECULES IN THE WIDELY DISTRIBUTED INTERSTELLAR CLOUDS. Davies, R. D.; Cohen, R. J.; Wilson, A. J. (Univ. of Manchester, Eng.). pp 115-119 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Observations showing the occurrence of neutral hydrogen, OH and H_2CO in a variety of widely distributed interstellar clouds are described. These clouds include those seen in absorption against strong radio sources and the dense dust clouds which produce strong optical obscuration. Such observations provide a useful guide to the formation processes of interstellar molecules. (auth)

23153 HOMOGENEITY AND THE KINETIC TEMPERATURE OF THE INTERCLOUD H I GAS. Hachenberg, O.; Mebold, U. (Max-Planck-Institut fuer Radioastronomie, Bonn). pp 120-123 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

The brightness temperature fluctuations which can be observed between the 21 cm intercloud gas emission from adjacent positions are interpreted to come from a random variation of the number of turbulence cells in the antenna beam. We find about 200 cells in our 36′ × 36′ beam. The velocity dispersion σ within one cell can be separated from the velocity dispersion τ of the centre velocities of the cells. We find $\tau/\sigma \approx 1.1$. From τ/σ and from the observed velocity dispersion of the emission lines we find $\sigma = 6.5\ \mathrm{km \cdot s^{-1}}$. This corresponds to a kinetic temperature $T_k \approx 5000$ K for the intercloud HI-gas. (auth)

23154 OUTER SPIRAL STRUCTURE OF THE GALAXY AND THE HIGH-VELOCITY CLOUDS. Davies, R. D. (Univ. of Manchester, Eng.). pp 124-128 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlan (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Outer spiral arms have been mapped using high sensitivity observations. Their velocity and location suggest a close association with the high-velocity clouds (HVCs). (auth)

23155 VERY LONG BASELINE INTERFEROMETER MEASUREMENTS OF H_2O MASERS IN ORION A, W49N, W30H, AND VY CMa. Papadopoulos, G. D. (Massachusetts Inst. of Tech., Cambridge). pp 129-130 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

A review is presented of the results of very long baseline interferometer measurements of the H_2O emission regions in Orion A, W49N, W30H and VY CMa. The observations were made in June 1970, February 1971, and March 1971 using the 120-foot antenna of the Haystack Observatory, the 140 and 36-foot antennas of the NRAO and the 85-foot antenna of the Naval Research Laboratory. (auth)

23156 HIGH RESOLUTION SEARCH FOR INTERSTELLAR LITHIUM. Utiger, H. E. (Middle East Technical Univ., Ankara). pp 131-139 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

New upper limits are given for the interstellar lithium abundance in the direction of HD 37128 (ϵ Ori) and HD 197345 (α Cyg). The upper limit on the equivalent width in the direction of HD 197345 is 2.54 mÅ and in the direction of HD 37128 is 4.06 mÅ. The possibility exists that lithium was detected in the clouds of HD 37128 but the statistics of the data preclude a positive claim of the detection of the lithium resonance absorption lines at 6708 Å. (auth)

23157 IONIZED GAS IN THE DIRECTION OF THE GALACTIC CENTER. I. Kinematics and Physical Conditions in the Nuclear Disk. Mezger, P. G.; Churchwell, E. B.; Pauls, T. A. (Max-Planck-Institut fuer Radioastronomie, Bonn). pp 140-156 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

A survey has been made of radio recombination line radiation from ionized gas in the direction of the galactic center. Interpretation of these observations suggests that the HII regions in the galactic center are ionized by recently formed massive stars and that the star formation rate in the region $150 \gtrsim R \gtrsim 50$ pc is extremely high. Star formation appears to be most active at positive galactic longitudes, where most of the molecular clouds and all discrete giant HII regions are observed. At negative longitudes star formation appears to have ceased, the region contains, apart from the extended HII region, only a few molecular clouds and two SN remnants. (auth)

23158 RESULTS OF LUNAR OCCULTATIONS OF THE GALACTIC CENTER REGION IN HI, OH, AND H_2CO LINES AND IN THE NEARBY CONTINUA. Sandqvist, A. (Stockholm Observatory). pp 157-163 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

A discussion of recent results of lunar occultations of the galactic center and the structure of the $+40\ \mathrm{km \cdot s^{-1}}$ absorption feature is presented. (auth)

23159 DIFFUSION OF ELEMENTS IN THE GALAXY. Basinska, E.; Iwanowska, W. (Inst. of Astronomy, Torun, Poland). pp 165-173 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Effects of gravitational separation of elements in the interstellar gas above the galactic plane are estimated for a very simple evolutionary model of the Galaxy. They show an increase of He/H and Fe/H contents in the solar vicinity by factors 1.15 and 4.0 respectively during the time interval of 14×10^9 years. (auth)

23160 INTERPRETATION OF FAR INFRARED OBSERVATIONS (INVITED LECTURE). Pottasch, S. R. (Kapteyn Astronomical Inst., Groningen, Netherlands). pp 209-231 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Possible interpretations of the far infrared (20 μm to 900 μm) observations are discussed. Attention is especially directed to compact HII regions, which may be a place of present star formation. The region of the galactic center and the nuclei of other galaxies are also considered. Emission by dust grains is considered in detail, as is line emission in this spectral region. The possibility of synchrotron emission is also discussed. (auth)

23161 INFRARED PHOTOMETRY OF GALACTIC H II REGIONS. Olthof, H.; Wijnbergen, J. J.; Helmerhorst, T. J.; van Duinen, R. J. (Univ. of Groningen, Netherlands). pp 243-247 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Far-infrared photometric observations of two galactic HII regions are presented together with observations of Jupiter for calibration. The results indicated higher values than observed by Hoffmann et al. (1971) which might be due to a larger extension of the sources. (auth)

23162 GALACTIC MODELS AND STELLAR ORBITS (INVITED LECTURE). Einasto, J. (Astrophysical Observatory, Toravere, USSR). pp 291-325 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

Methods of construction composite models of galaxies are outlined. The available observational information renders it possible to distinguish the following populations in nearby galaxies: nucleus, core, bulge, halo, disk, young population. Parameters of models are presented on six galaxies (our Galaxy, M31, M32, M87, and the dwarf galaxies in Fornax and Sculptor). New data indicate that the degree of mass concentration to the centre of the galaxies is much higher than adopted in previous models, and that giant galaxies may be surrounded by massive coronae of very large dimensions. Recent developments in the derivation of stellar orbits and kinematical characteristics of various stellar popu-

lations in galaxies are also summarized. In the last section models of the physical and dynamical evolution of galaxies are discussed. (auth)

23163 COMPARATIVE STUDY OF PERIODIC ORBITS (m < 4) IN VARIOUS THREE-DIMENSIONAL MODELS OF OUR GALAXY. Martinet, L.; Mayer, F. (Observatoire de Geneva). pp 355-357 of Stars and the Milky Way System. Mavridis, L. N. (ed.). Berlin; Springer-Verlag (1974).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-P2.

The paper presents some general conclusions deduced from a systematic exploration of m-periodic orbits (m < 4) calculated in the Schmidt models (1956 and 1965) of the Galaxy. (auth)

23164 HISTORY OF THE CHEMICAL EVOLUTION OF OUR GALAXY. Stroemgren, B. (Univ. of Copenhagen). Fys. Tidsskr.; 72: No. 2-3, 135-142(1974). (In Danish).

It has been known for more than 20 years that the oldest stars in our galaxy, the so-called halo stars, have relatively a very low content of elements heavier than hydrogen and helium. These stars are believed to have been formed around 12 milliard (12×10^9) years ago, at a time when the very attenuated components of the galaxy existed in a practically spherical body. The sun is regarded as having originated around 4.5 milliard years ago, and its around 2% of heavier elements represents a great increase over that in the halo stars. In the major stars conversion of helium to carbon, nitrogen, and oxygen has occurred to some degree. Further investigations are required on the relation between the place where a star was formed and its age, on the one hand, and its chemical composition on the other. In an Appendix figures are given for the radiation into interstellar space of enriched and unenriched material (with and without heavier components than helium) from stars within various mass intervals. (ADN)

23165 HIGH RESOLUTION 6 cm OBSERVATIONS OF SEYFERT GALAXY NUCLEI. de Bruyn, A. G.; Willis, A. G. (Rijksuniversiteit Leiden (Netherlands). Sterrewacht). Astron. Astrophys.; 33: No. 3, 351-356(Jul 1974).

We present observations at 6 cm wavelength of the Seyfert galaxies NGC 1068, 3227, 4151 and 7469 as well as the Seyfert-like galaxy NGC 2782. Except for NGC 3227 all sources are resolved. The maximum resolution attainable is about 2″. Each galaxy has a spectral index close to −0.80. Our data and those of Bash (1968) suggest a two-component model for NGC 1068. The compact component has a flat spectrum but probably has not varied significantly over the last 8 years. (auth)

Cosmology

Refer also to abstract 23079.

23166 (N-73-28753, pp vp Paper 14) MATTER--ANTIMATTER COSMOLOGY. Omnes, R. (Paris Univ., Orsay, France). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A report of recent work concerning the possible existence of antimatter on a large scale is given. The following topics are covered: coalescence, the annihilation rate, galaxy formation, antimatter and gamma rays, the evidence for antimatter, and an oecumenical model for quasars. (BJG)

23167 (N-73-28753, pp vp Paper 15) DEUTERIUM PUZZLE IN THE SYMMETRIC UNIVERSE. Leroy, B.; Nicolle, J. P.; Schatzman, E. (Observatoire, Meudon, France). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The examinations of the experimental data concerning the reaction anti p + ^{4}He yields pions + nuclei shows that the low abundance of ^{2}D can be explained only by assuming a low He abundance at the beginning of the radiative era. This is a completely independent confirmation of the evasion of neutrons (and antineutrons) from the emulsion before the end of the epoch where nucleogenesis might have taken place, and leads to an estimate of the size of the emulsion when T equals 1 MeV, L approximately $0.10^{4\pm6}$ cm. (auth)

23168 (N-73-28753, pp vp Paper 16) GAMMA-RAY BACKGROUND SPECTRUM AND ANNIHILATION RATE IN THE BARYON-SYMMETRIC BIG-BANG COSMOLOGY. Puget, J. L. (Observatoire, Meudon, France). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A baryon-symmetric cosmological model is presented and annihilation rates are calculated for accretion of intergalactic gas on large galaxies and galaxy–antigalaxy collisions. The best direct experimental test for the presence of antimatter on a cosmological scale lies in the gamma-ray background spectrum between 1 and 70 MeV. (BJG)

23169 (N-73-28753, pp vp Paper 17) DISTORTION OF THE MICROWAVE BLACKBODY BACKGROUND RADIATION IMPLIED BY THE BARYON-SYMMETRIC COSMOLOGY OF OMNES AND THE GALAXY FORMATION THEORY OF STECKER AND PUGET. Stecker, F. W. (Goddard Space Flight Center, Greenbelt, MD); Puget, J. L. Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The problem of blackbody distortion due to antimatter annihilation is discussed. The annihilation rate must be large enough to provide the turbulence needed to explain galaxy formation and yet not produce a distortion in conflict with present observations of the microwave blackbody radiation. (BJG)

23170 (N-73-28753, pp vp Paper 18) ANTIMATTER IN THE UNIVERSE. Steigman, G. (Yale Univ., New Haven). Jun 1973.

From NASA international symposium and workshop on gamma ray astrophysics; Greenbelt, Maryland, USA (20 Apr 1973).

In international symposium and workshop on gamma-ray astrophysics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The means of detecting the presence of antimatter in the universe is discussed. Straightforward observational tests prove negative, implying that the Universe is not symmetric. On the other hand, if matter and antimatter are well separated from each other, it is possible that the Universe is symmetric. (BJG)

Planetary Phenomena

Refer also to abstracts 23059, 23063, 23064, 23070, 23132, and 23146.

23171 INTERSTELLAR RARE GAS FRACTION IN THE SOLAR WIND (He, Ne, Ar). Fahr, H. J. (Univ., Bonn). pp 37-52 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German).

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

Relative elemental abundances in the solar wind have been determined by means of energy spectrometers and solar wind collection foils. It is discussed whether abundances derived from such measurements are characteristic for the elemental composition of the original solar wind and solar corona. In particular, the influence of the neutral interstellar gas entering the solar system on the measured abundances is studied. It is shown that the interstellar gas suffers appreciable changes in its relative elemental composition, while advancing towards the sun. This leads to the conclusion that in special cases solar wind abundance measurements may have to be corrected for a contribution from the interstellar gas. (auth)

23172 INTERPRETATION OF THE ^{14}C DEPTH PROFILE IN A LUNAR STONE. Born, W. (Max-Planck-Institut fuer Chemie, Mainz). pp 65-74 of Analyse Extraterrestrischen Materials. Kiesl, W. (ed.). Vienna; Springer-Verlag (1974). (In German).

From analysis of extraterrestrial materials; Wien, Austria (2 Oct 1973). See CONF-7310107-.

The ^{14}C-depth profile has been measured in the lunar sample 12053. It agrees with former estimations on the rigidity of solar protons of 80 to 100 MV. The flux accounts 100 prot./cm^2.sec (E > 10 MeV), averaged over a number of solar cycles. Surface implanted ^{14}C is regarded as due to a solar ^{14}C-flux of about 6, 6.10^{-4} ^{14}C/cm^2.sec near the earth. (auth)

23173 TYPICAL SEQUENCE OF STRONG DISCONTINUITIES IN THE LEADING EDGE OF A NONSTATIONARY INTERPLANETARY PLASMA FLOW. Ivanov, K. G.; Mikerina, N. V.; Yevdokimova, L. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 665-670(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 777-783(1974).

Views on the structure of a typical interplanetary plasma flow are refined by introducing into the flow model a strong discontinuity between the shock front and the front of the "flare" plasma and the "magnetic region" bound by this discontinuity and having maximum absolute magnetic field values. It is found that the dynamic and magnetic pressures are equal at the boundary of the magnetic region. (3 figs., 18 refs) (auth)

23174 SEARCH FOR SUPERHEAVY ELEMENTS IN METEORITES. Popeko, A. G.; Ter-Akop'yanan, G. M.; Skobelev, N. K.; Goncharov, G. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1220-1226(Jun 1975). (In Russian).

Neutron emission from samples of meteorites Saratov, Efremovka and Allende is measured by means of the neutron multiple emission detectors. An activity exceeding the background due to spontaneous Uranium fission is detected. A possible relation of the observed activity with the spontaneous fission of superheavy elements and anomalies in the abundance of heavy xenon isotopes in the meteorites is discussed. (2 tables, 7 figures) (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 23072, 23093, 23224, 23226, and 23267.

23175 (N-74-28246, pp vp, Paper 2) GEOGRAPHICAL DISTRIBUTION OF APPROX. 100-keV ELECTRONS ABOVE THE EARTH'S ATMOSPHERE. Seward, F. D. 3 Oct 1973.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Previously unpublished satellite data is used to show the distribution of approximately 100-keV electrons above the earth's atmosphere. Specific regions of high counting rate are mapped at altitudes of 300 to 400 km. These regions are used to predict the suitability of various launch sites for rocket-borne x-ray astronomical experiments. (auth)

23176 (N-74-28246, pp vp, Paper 3) QUASITRAPPED ELECTRONS IN THE LOW L REGION. Preliminary Results of a Rocket Observation on January 22, 1974. Hayakawa, S.; Kohno, T.; Nagase, F.; Tanaka, Y. (Nagoya Univ., Japan). 1974.

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Suprathermal electrons in the energy range 5–100 keV were measured with thin-window proportional counters on board a sounding rocket L-3H-8 launched from Kagoshima Space Center at 2000 JST (1100UT) on January 22, 1974. The flux of the electrons was found to increase with altitude in the range 100–550 km, corresponding to L equals 1.15–1.22, the angular distribution to be peaked in the direction perpendicular to the geomagnetic line of force, and the energy to be represented by a power law. These features are similar to those which were observed in earlier flights with L-3H-7 and K-9M-40. But the absolute flux was in between the fluxes observed in the earlier experiments. The results to be presented in what follows are preliminary, since data are not completely analyzed yet. (auth)

23177 (N-74-28246, pp vp, Paper 4) LOW ENERGY (10 eV TO 10 keV) EQUATORIAL PARTICLE FLUXES. Including Soft Particle Fluxes Near the Equator. Winningham, J. D.; Heikkila, W. J. 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

In this report three things will be done. The first will be corrections and additions to the paper entitled "Soft Particle Fluxes near the Equator" by W. J. Heikkila (attached as Appendix A) which was based on ISIS-1 satellite data. The second part will deal with preliminary data obtained from a sounding rocket launched at the magnetic equator (Lima, Peru). Finally, conclusions relative to x-ray contamination will be drawn. (auth)

23178 (N-74-28246, pp vp, Paper 5) AE-LEE MEASUREMENTS AT LOW AND MID LATITUDE. Hoffman, R. A.; Burch, J. L.; Janetzke, R. J. 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Shortly after the Low Energy Electron Experiment (LEE) on the Atmosphere Explorer-C was turned on following launch, an unexpected phenomenon was encountered at mid-latitudes: a counting rate was acquired with one maximum per roll. It was immediately surmized that the experiment was observing the low latitude fluxes of Freeman (1962) and Heikkila (1971). However, further analysis of the initially acquired data cast some doubt on the validity of that assumption, and, in fact, even on the validity of the counts registered by the detectors. Most recent analysis shows that these counting rates occur when the detectors are looking in the ram direction of the spacecraft and the spacecraft is near perigee, and are indeed not due to properly analyzed charged particles. The probable cause of these counting rates and some upper limits to true fluxes at low altitudes in the energy range 200 eV to 25 keV from the LEE experiment are discussed. A small amount of OGO-4 data taken at mid-latitudes is also presented. (auth)

23179 (N-74-28246, pp vp, Paper 6) MIDLATITUDE ELECTRON PRECIPITATION: A POSSIBLE SOURCE OF CONTAMINATION OF GALACTIC X- AND GAMMA-RAY MEASUREMENTS. Rosenberg, T. J. (Univ. of Maryland, College Park). 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

From the few direct measurements available, and from inferences drawn from ionospheric observations, it would appear that the precipitation of electrons at middle and even low latitudes may occur more frequently than is generally supposed. VLF radio wave propagation measurements at night support this contention for electrons with energies greater than or equal to 40 keV. The flux levels, except in unusual circumstances, are much lower than those typical of auroral latitudes, but nevertheless may pose a problem to some measurements of galactic X and gamma-rays. Less is known about the precipitation of lower energy electrons on either the night or day sides. (auth)

23180 (N-74-28246, pp vp, Paper 7) ELECTRON CONTAMINATION IN A MID-LATITUDE SOFT X-RAY ASTRONOMY EXPERIMENT DURING AN INTENSE MAGNETIC STORM. Naranan, S.; Friedman, H.; Fritz, G.; Henry, R. C.; Shulman, S. (Naval Research Lab., Washington, DC). Jun 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A large area X-ray sky survey payload was launched from White Sands Missile Range (106°W. 32°N) on 1 Nov 1972 at 0530 hours U.T. The launch time coincided with intense geomagnetic activity (3 hour Kp index equals 8) following a solar flare. The data have been analyzed to determine possible contamination of x-ray data by large fluxes of low energy electrons that can precipitate down to low altitudes during magnetic storms. There is clear evidence in the data for low energy electrons of 10–50 keV contributing appreciably at approximately 200 km altitude in the 1–10 keV x-ray energy channels of the proportional counters used for the x-ray observations. The McIlwain parameters L and B for this altitude at White Sands are 1.25 and 0.46G, respectively. Most of the contribution occurs at large pitch angles with respect to the local magnetic field direction. The extent of electron contamination depends on the counter window thickness. In the present experiment, electrons did not affect appreciably γ-ray data in x-ray energy channels below 1 keV. (auth)

23181 (N-74-28246, pp vp, Paper 8) SOFT X-RAY BREMSSTRAHLUNG AND FLUORESCENT LINE PRODUCTION IN THE ATMOSPHERE BY LOW ENERGY ELECTRONS. Kraushaar, W. 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Several clues, such as pulse height distribution and angular distribution, that reveal the presence of low energy quasi-trapped or precipitating electrons capable of by-passing magnetic rejection schemes and penetrating the counter windows of soft x-ray detectors are discussed. (BJG)

23182 (N-74-28246, pp vp, Paper 9) GEOMAGNETIC BACKGROUND EVENTS OBSERVED BY UHURU. Schwartz, D. A. (Smithsonian Astrophysical Observatory/Harvard College Observatory, Cambridge, MA). 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space

Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Problems due to sporadic background events observed by Uhuru (Small Astronomy Satellite - A) have not been examined systematically since they do not compromise the study of discrete x-ray sources. Nevertheless, direct particle effects and auroral type x-ray events in the atmosphere may occasionally occur. Therefore, even on the geomagnetic equator, an experiment must be prepared to recognize and eliminate such events when the ultimate level of sensitivity is desired. (auth)

23183 (N-74-28246, pp vp, Paper 10) PARTICLE BACKGROUND OBSERVED BY THE X-RAY DETECTORS ONBOARD COPERNICUS. Davison, P. J. N. (Mullard Space Science Lab., Dorking, Eng.). 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

A description of the procedures followed in subtracting background counts from the raw data is given. Methods of recognizing and treating anomalous behavior are also presented. (BJG)

23184 (N-74-28246, pp vp, Paper 11) SURVEY OF TRAPPED LOW ENERGY ELECTRONS NEAR THE INNER BOUNDARY OF THE INNER RADIATION ZONE FROM THE OSO-7. Neighbors, J. E.; Clark, G. W. 1974.

From workshop on electron contamination in x-ray astronomy experiments; Washington, District of Columbia, USA (26 Apr 1974).

In proceedings of the workshop on electron contamination in x-ray astronomy experiments. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

Data from the MIT x-ray experiment on the OSO-7 satellite were used to delineate the regions in B-L and geographic spaces where trapped radiation was encountered. The results pertain specifically to electrons with energies in a range of 10 keV centered on 55 keV which were encountered in an orbit between altitudes of 330 and 570 km and latitudes of $+\text{-}33.3^{0}$. A typical pitch angle distribution is fitted by a Gaussian with a FWHM of 28 degrees. (auth)

23185 GEOMAGNITNYE I IONOSFERNYE VOZMUSHCHENIYA V VYSOKIKH SHIROTAKH. (Geomagnetic and Ionospheric Disturbances in the Upper Latitudes). Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). 164p.

Seventeen articles concerned with geomagnetic and ionospheric disturbances are presented. (BJG)

For abstracts of individual papers see: 23186–23200, 23227, and 23267.

23186 DEVELOPMENT OF THE POLAR IONOSPHERIC DISTURBANCE. Sukhorukova, E. V. pp 3-11 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The sequential development with time of polar ionospheric substorms in upper ionosphere was examined. The time pattern of such storms can be divided into three stages: initial phase of ionospheric disturbance, which develops as an increase of the electron component + Δf_0F2; negative phase – Δf_0F2, coinciding in time with magnetic substorms; and the phase for the reduction of the ionospheric to a normal state with steady magnetic field. The positive phase of the ionospheric substorm is observed only in the daylight hours after sudden inception of a magnetic storm and does not depend on the status of the local magnetic field. The negative phase of the ionospheric disturbance can be characterized by the following parameters: maximum size of the deviation of the electron component from calm levels, with time necessary to achieve this maximum deviation, and a general persistence of the disturbance. The parameters of the negative deviation, which were stable for one season and changed with change of the season, were determined. (tr-auth)

23187 MULTILAYER NIGHT F-REGION OVER MURMANSK. Shul'gina, N. V. pp 12-17 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

On the basis of observations of the ionosphere by the method of vertical probing, it was noted that with increase of the solar activity some reflecting structures are formed in the F region in the night time. Together with the residual night ionization of the regular F2 layer, there is an abnormal ionization which often becomes primary during the course of the night; meanwhile in the diurnal pattern of f_0F2 a significant night maximum is formed. Rather often there are sporadic formations in the F region which can be either much larger than f_0F2 or much smaller according to the limiting frequency. Consequently at the same time all four layers can sometimes be observed on the ionogram. Such multilayers in the F region are not directly connected with the level of the magnetic activity and the presence of a supplementary ionization source is proposed. (tr-auth)

23188 VARIATIONS OF ELECTRON DENSITY PROFILES DURING NEGATIVE MAGNETIC BAYS IN AURORAL ZONE. Mizun, Yu. G.; Bryunelli, B. E.; Khviyuzova, T. A. pp 18-29 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian).

The electron profiles, calculated from ionograms, at the Murmansk station after 11 negative bays were studied. It was shown that the change of the electron density in the maximum of the F2 region is more complex than at altitudes from 100 to 250 km. Short-lived changes of the electron density were found at all levels and these were correlated with changes of the geomagnetic field. It was shown that the change of the profile is caused by the supplementary ionization by incoming electron and electrodynamic drifts. (tr-auth)

23189 CONDUCTIVITY OF THE IONOSPHERE OVER SOUTH POLE. Astakhov, P. G.; Lyatskaya, A. M.; Bryunelli, B. E. pp 29-33 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

During three incomplete days in the autumn of 1967, the height profiles of the Pedersen and Hall conductivities $\sigma_1(h)$ and $\sigma_2(h)$ and consequently the integral profiles Σ_1 and Σ_2 from the N(h) profiles were measured over the South Pole. The dependence of the conductivity on the magnetic activity was studied. The growth of the conductivity with increase of the K index was observed. The ratio Σ_2/Σ_1, also growing with increase of K, remains less than 1 at the polar cap and exceeds 1 in the polar zone. (tr-auth)

23190 UNSTEADINESS OF THE ELECTRON CONCENTRATION IN THE IONOSPHERE. Sukhorukhova, E. V. pp 41-53 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

Values were obtained of the variability of the electron concentration $\overline{\Delta N}$ from the ionospheric N(h) profiles during solar activity maxima and it was found that in a series of cases the smooth increase of dispersion with height, characteristic for a minimum year, was disturbed. The effect that each term of the equation of continuity can have on the observed variability of the electron concentration was examined. Under the assumption that the variability of the movement of the electron-ion gas is small, the values $\overline{\Delta N}$ were calculated at different altitudes. For calculation of $\overline{\Delta N}$, values were obtained for the effective recombination coefficient $\alpha^*(h)$ for different ionospheric conditions. The values which can affect the values of $\alpha^*(h)$, such parameters as the electron temperature and the density of the neutral atmosphere, were calculated. It was shown that the instability of the ion formation function, of the order of 3 to 5%, can explain the observed changes of the electron concentration. (tr-auth)

23191 DETERMINATION OF THE INCIDENT ELECTRONS SPECTRUM BY THE E-LAYER PARAMETERS DURING MAGNETO-IONOSPHERIC DISTURBANCES. Tsirs, V. E. pp 53-55 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian).

It was assumed that a sporadic layer is formed by the intrusion of electrons whose energy spectrum has the form $I_0 \exp(E/E_0)$. The parameters of the spectra of I_0 and E_0 were determined from the frequencies f_0E_{st} and f_bE_s and the altitude. It was found that the correlation function between I_0 and the amplitude δH, accompanying the disturbance of the geomagnetic bays is close to 0.82 but between E_0 and δH it is small. The pattern of I_0 and E_0 during one disturbance was analyzed. It was found that at the beginning of the disintegration E_0 is not changed but at the end of the disturbance it has increased. I_0 at the moment of the beginning of the disturbance increased more than an order of magnitude. (tr-auth)

23192 CONNECTION BETWEEN POLAR AURORA LUMINOSITY AND E_s-PARAMETERS. Roldugin, V. K.; Tsirs, V. E. pp 66-69 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian).

Recordings of the integral intensity of the zenith luminosity obtained with a photometer with visual angle of $\sim 60^{\circ}$ and a given ion probe and recorded in 1967 and 1968 in Loparsk were used. In all 19 nights were examined during which 706 cases of reflection from the E_s layer were recorded when observations of the polar aurora were possible. For each disturbance a similar and linear dependence between the intensity of the luminosity and the f_bE_s and f_0E_{st} parameters was obtained. The correlations of the

intensity of the luminosity with $f_i E_s$ were weak and occurred in the limits 0 to 0.5. (tr-auth)

23193 PITCH-ANGLE EFFECTS ON THE LUMINOSITY HEIGHT DISTRIBUTION. Ivanov, V. E. pp 78-84 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The pitch-angle effect of auroral electrons having a differential energy spectra of the form $N(E) = N_0E^n\exp(-E/\alpha)$, on the luminosity profile at λ 3914 Å emission was examined. It was shown that the vertical dimensions of the luminosity, the magnitude of the luminosity at a maximum, and the location of the maximum undergo significant changes. The size of Δ H can change in the limits 50 to 200 km which is characteristic for the vertical dimensions of the form of the polar aurora. The role of Coulomb scattering on the ions was evaluated. It was concluded that the appearance of a radiant form, especially the quiet homogeneous arc–luminous arc–individual beam transitions on the night side, can be connected with suppression of the intrusive electrons to 90° and simultaneously with the softening of the energy spectrum. It was proposed that the sharp increase of the degree of ionization at heights of 250 km and above leads to an increasing role of electron-ion and electron-electron interactions and to a very strong diffusion of the luminosity with altitude. (auth)

23194 PECULIARITIES OF THE DIURNAL VARIATIONS OF THE POLAR AURORA SPECTRA. Roldugin, V. K.; Starkov, G. V.; Totunova, G. F. pp 84-90 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The singularities of the diurnal variation of the spectral characteristics in observations at the Loparsk station in 1966-67 were studied. A decrease in the morning hours of the emission ratios J(λ 5577 Å)/J(λ 4278 Å) and J(λ 5577 Å)/J(1 PGN_2) was observed for three areas of the sky at 67, 65, and 63°. Such a diurnal pattern indicates an increase in the morning of the energy of the auroral electrons. It was shown that J(λ 5577 Å)/J(λ 4278 Å) at all hours decreases with increase of K, whereas at K_p 8 this ratio at all hours remains approximately the same. This signifies an equalization of the particle energies throughout the night side during significant magnetic disturbances. In the morning hours a close relationship was observed between the luminosity 1 PGN_2 and the appearance of pulsating aurora. (tr-auth)

23195 HYDROGEN IN THE DIFFERENT POLAR AURORA TYPES. Totunova, G. F. pp 90-95 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian).

By means of photoelectric spectrometers at Loparsk the distribution of the H_β emission in aurorae of different forms was studied. It was shown that the emission of hydrogen is not connected with any of the bright forms of aurorae. The hydrogen is present independently of them and is shown in the form of bands extending to latitudes no lower than 3° and is visually undetectable. It was found that the H_β emission does not increase at the moment of decay of the bright forms of aurorae. The presence of hydrogen was observed in pulsating aurorae and it was independent of the pulsation of the intensity oscillation of the H_β emission with dominant period of 5 min. (tr-auth)

23196 CONNECTION BETWEEN THE RADIO AURORA AND THE POLAR AURORA. Sverdlov, Yu. L.; Sergeeva, N. G.; Pyatsi, A. Kh. pp 95-108 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The statistical relation between the frequency of the appearance of polar aurora in some area and the frequency of registration of auroral radioechoes in this same region was examined. The examination was made on the basis of a new model of the scattering properties of radioaurora with a narrow scattering indicatrix and a "floating direction of the maximum". In such a model of the radioecho from a region filled with auroral inhomogeneities, specific radio-luminescent aurorae are registered not always, but only in those cases where the direction of the indicatrix maximum approximately coincides with the direction from the region to the radio-luminescent aurorae. General formulas were obtained for the calculation of the probability of the registration of the radioecho and numerical calculations were made for three specific experiments described in the literature. The results of the calculations, made under the assumption that all electron aurora are accompanied by the appearance of radioaurorae, agree well with experimental data. The agreement confirms the validity of the original assumption that the appearance of visual forms of aurorae are always (or almost always) accompanied by the appearance of radioaurorae. (tr-auth)

23197 COSMIC AND X-RAY MEASUREMENTS IN STRATOSPHERE BY THE BALLOON-BORNE RKL-10M RADIOSONDE. Borovkov, L. P.; Vetrina, M. A.; Zhavkov, V. A.; Kuzmin, I. A. pp 119-124 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, G. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The results of the first measurements made with the RKL-10M radioprobe for cosmic radiation and auroral radiation were examined. The recordings were made with scintillation and Geiger detectors at different background levels of the radiation of the galactic component of cosmic radiation and examples were given of auroral x-ray radiation. (tr-auth)

23198 RADIO-WAVE PROPAGATION THROUGH THE POLAR CAP. Kukushkina, R. S.; Pudovkin, M. I.; Starkov, G. V. pp 125-131 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The probability of the passage of radiowaves of different frequency through the polar cap was examined for three moments of universal time. Schemes were given for the propagation of radiowaves with consideration of the M reflection. Their validity were confirmed in each specific case by the singularities of the state of the ionosphere at corresponding points. It was shown that the ionospheric parameters at the polar cap are almost independent of the magnetic activity and therefore the diurnal variation of the ionospheric state at the polar cap has the basic effect on the propagation of radiowaves. The role of the magnetic activity begins to be apparent only during significant disturbances caused by expansion of the aurora and leading to absorption of the radiowaves. (tr-auth)

23199 POLARIZATION OF Pi2-PULSATIONS IN AURORAL ZONE. Afanas'eva, L. T.; Raspopov, O. M. pp 131-136 of Geomagnitnye i Ionosfernye Vozmushcheniya V Vysokikh Shirtakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The singularities of the polarization of type Pi2 geomagnetic pulsation from data obtained during synchronous sessions in March and April of 1968 at stations located in auroral and subauroral latitudes are studied. These annual cyclic diurnal recordings of the Lovozer station were analyzed. The results obtained indicate that in the auroral zone the behavior of the Pi2 vector differs in comparison with the middle latitudes. There is a diurnal rotation pattern for the polarization vector. At the latitude of Lovozer–Loparsk there is a significant number of Pi2 cases with mixed polarization. In the transition from subauroral to auroral latitudes, a change in the rotation direction of the Pi2 vector can occur. (tr-auth)

23200 POSSIBILITY OF DETERMINATION OF SOME INHOMOGENEOUS PLASMA PARAMETERS BY TRAJECTORY DATA. Boyarintsev, E. L.; Gorokhov, R. A. pp 146-155 of Geomagnitnye I Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The problem of the determination of the parameters of large-scale inhomogeneities in the ionosphere was examined on the basis of experimentally measured characteristics of the propagation of radiowaves during oblique probing using sets of different models. For each model a complete system of equations connecting the parameters of the medium was derived and approximate solutions were obtained for media with small horizontal gradients. Evaluations were made of the actual gradients from experimental data obtained on auroral radiotracks. (tr-auth)

23201 GEOMAGNETIC FIELD AND THE CONTENT OF THE ^{81}Kr ISOTOPE IN THE ATMOSPHERE. Barabanov, I. R.; Golubev, A. A.; Pomanskii, A. A. (Inst. of Space and Research, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 788-789(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 924(1974).

The relation between the emissions of the stratosphere and mesosphere is studied. It is found that: (1) In periods when the temperature field at the 10- and 30-mb levels in the stratosphere is quiet, the mesospheric emissions behave entirely independently of the state of the stratosphere, (2) when the temperature of the stratosphere at the observation point changes smoothly by 3–4°K in the course of the day and by ~15°K in the course of a week, the Trot(OH), I(OH), I(Na), and T and H of the stratosphere change synchronously, (3) When the daily fluctuations of stratospheric temperature are ~10°K, which is typical of stratospheric warmings with increasing T and H, Trot(OH) and I(OH) decrease. These effects are correlated with seasonal and lunar effects. (1 fig, 16 refs) (GHT)

23202 INTERRELATION BETWEEN AURORAL SCATTERING AND AURORAS. Loginov, G. A.; Pudovkin, M. I.; Strakov, G. V.;

Uspenskii, M. V. (Inst. of Atmospheric Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 783-785(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 918-919(1974).

The relative orientation of aurorae and radio aurorae was determined from the angle between the tangents to the emission and radio aurora regions. If the regions are close in space, they are approximately parallel. As the distance between them increases, their orientation changes such that they become mutually perpendicular. The radio aurorae are observed with a large degree of probability at the boundary of the emission region, and it is assumed that this property makes it possible for a radar station to detect the E region with sharp conductivity gradients under favorable conditions. (2 figs, 12 refs) (GHT)

23203 ONE OF THE HEATING MECHANISMS OF THE POLAR MESOSPHERE. Bagno, Yu. D.; Osipov, N. K. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 781-783(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 916-917(1974).

The effect on the temperature of the neutral atmosphere of the vertical transport of $O_2(^1\Delta g)$ molecules (lifetime of $\sim 10^4$ sec) that appear as the result of the excitation of molecular oxygen by secondary electrons at a height h is investigated. (1 fig., 10 refs.) (GHT)

23204 EFFECT OF THE X-RAY EMISSION OF THE SOLAR FLARE OF AUGUST 2, 1972, ON THE IONIZATION OF THE IONOSPHERIC E REGION. Odintsova, I. N.; Leshchenko, L. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 772-775(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 907-909(1974).

Ionization at various ionospheric levels due to solar x-rays based on x-ray levels measured by the Solrad 10 and Explorer 44 satellites is discussed. Ionization is shown vs. time and altitude. (3 figs) (GHT)

23205 DAILY AND SEASONAL VARIATIONS OF THE FREQUENCY OF OCCURRENCE OF TRAVELING DISTURBANCES IN THE IONOSPHERE. Ploshchenko, O. S.; Chernysheva, S. P. (Rostov State Univ., USSR). Geomagn. Aeron. (Transl.).; 14: No. 5, 775-777(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 910-911(1974).

Variations in the number of travelling ionospheric disturbances are related to the mechanism of generation of gravity waves, their conditions of propagation and the conditions under which they penetrated into the atmosphere. Observations were made at latitudes of 58°, 50°, 42°, 36°, 32°, and 19°, and daily variations of the frequency of occurrence of travelling disturbances are shown. Latitudinal variations of the instants of local time are plotted to indicate the motion of the main mass of the disturbances from the injection point toward the equator. Seasonal variations are based on gravity wave propagation into the F region being dependent on circulation in the neutral atmosphere which affects vertical propagation. The most favorable propagation conditions occur in winter, making travelling disturbances more likely. (GHT)

23206 MEASUREMENT OF THE HORIZONTAL SPEED OF TRAVELING IONOSPHERIC DISTURBANCES BY THE D1 METHOD. Drobzhev, V. I.; Kudelin, G. M.; Nurgozhin, B. I.; Pelenitsyn, G. M.; Troitskii, B. V. (Ionospheric Sector, Alma-Ata, USSR). Geomagn. Aeron. (Transl.).; 14: No. 5, 777-779(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 912-913(1974).

To develop a method for determining the parameters of a large-scale reflecting screen for working on the split segment of an ionogram, the fading representing the model of an experiment of spaced reception with a small base has been computed. The assumptions for the computation are given, and model fading is computed and shown for two antennas spaced 80m apart. Computer generated auto- and cross-correlation functions of the curves of synthesized fading are shown along with the geometry of the model measuring triangle. The horizontal phase velocity component of the disturbance was computed to be 57 m/sec at an angle $\phi = 148°$ (the direction measured clockwise from the North-South axis). Comparison with experiment indicates that the method of computing the magnitude and horizontal velocity direction gives accurate results. (2 figs.) (GHT)

23207 PRELIMINARY SUBSTORM PHASE IN THE F REGION OF THE IONOSPHERE. Uvarov, V. M.; Skhviyuzova, T. A. (Polar Geophysical Inst., Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 770-772(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 905-906(1974).

The preliminary phases of an auroral substorm include an increase in the auroral intensity on the day side of the auroral oval, and the appearance of a specific current system in the polar cap with an intensity maximum on the day-morning side of the auroral oval. These two phenomena lead to a disturbance of the F region of the day side before commencement of the magnetic bay. This disturbance is observed as a decrease in foF_2 with a maximum deviation from quiet level 1 to 1.5 hrs. before the maximum of a negative magnetic bay. Observations for several substorms are shown. (2 figs, 11 refs) (GHT)

23208 MAGNETIC SUBSTORMS OF FEBRUARY 15-16, 1971, AND ELECTRON FLUX VARIATIONS ACCORDING TO OBSERVATIONS IN ARKHANGEL'SK. Ben'kova, N. P.; Kozlov, E. F.; Osipov, N. K.; Samorokin, N. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 729-732(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 855-858(1974).

The results are discussed of a study of the temporal variations of the energy characteristic of auroral electrons during three substorms on February 15-16, 1971, based on photometric and riometric measurements and vertical ionospheric sounding data from Arkhangel'sk (L = 4.09). The method used is described and the results obtained are compared with the characteristics of development of magnetic disturbances. (auth)

23209 INSTABILITIES OF WHISTLERS PROPAGATING AT A SMALL ANGLE TO THE MAGNETIC FIELD. Lundin, B. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 747-750(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 876-880(1974).

The regions are found (in the variables $c\ \omega_c/2\omega_p v_{||}$, ω/ω_c, $T_{||}/T_\perp$, j; j is the parameter of the loss cone) where the buildup of high-frequency ($\omega \lesssim \omega_c$) whistlers propagating along the magnetic field is most likely to occur. The possible regions where the buildup of broad angular whistler spectra may occur are indicated. The compact form for the increment of oblique whistlers, obtained by the method of Einstein relations, is used in the investigation. An anisotropic Maxwell distribution with a loss cone is used as the distribution function simulating a minor hot electron component in a cold magnetospheric plasma. (auth)

23210 FLUXES OF SECONDARY ELECTRONS FROM PRECIPITATING ELECTRONS IN THE MID-LATITUDE DAYTIME ATMOSPHERE. Vlasov, M. N. (Inst. of Applied Geophysics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 765-767(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 900-901(1974).

The primary daytime flux of precipitating electrons with energies 1-40 keV is used to calculate the secondary electron flux due ion production. This secondary electron flux is compared with the computed photoelectron flux and it is found that fluxes of secondary electrons predominate at altitudes below 150 km for the given spectrum of primary electrons with a flux of 0.3 erg/cm^2·sec. (15 refs) (GHT)

23211 ENERGY TRANSFER BY SLOW ELECTRONS TO THE IONOSPHERIC GAS. Kudryavtsev, V. P.; Strelkov, A. S. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 768-770(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 902-904(1974).

Data are compared on the energy losses of electrons on individual ionospheric components. The average portion of the energy lost by an electron in collisions at heights of 100-500 km is computed on the basis of selected values of average energy losses on individual ionospheric components. (15 refs, 1 fig) (GHT)

23212 REGULAR VARIATIONS OF THE DAYTIME ELECTRON DENSITY PROFILE OF THE LOWER IONOSPHERE AT MIDDLE LATITUDES. Orlov, A. B.; Sazeyeva, N. N. (Leningrad State Univ.). Geomagn. Aeron. (Transl.).; 14: No. 5, 702-705 (1974).

Translated from Geomagn. Aeron.; 14: No. 5, 821-825(1974).

The regular variations of the electron density profile, determined by the solar zenith angle and season, are analyzed for middle latitudes and the height interval 65-85 km from published data. To describe these variations, a model of the lower ionosphere is constructed in the form of some parametric representations. (4 figs, 16 refs) (auth)

23213 SOME CHARACTERISTICS OF THE RAY TRAJECTORIES OF LOW-FREQUENCY ELECTROMAGNETIC WAVES IN THE TOPSIDE IONOSPHERE. Likhter, Ya. I.; Shubayev, L. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 706-710(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 826-832(1974).

The properties of the ray trajectories of low-frequency waves in a monotonically homogeneous multicomponent topside iono-

sphere are analyzed. It was found that the form of the trajectory can change sharply with a small change in initial latitude on frequencies $f < f_{1\,hz}$. The effect of a deflection of the wave vector from the vertical at the initial point on the trajectory is examined. (3 figs, 15 refs) (auth)

23214 NEGATIVE ABSORPTION IN THE LAMBDA 6300 TO 6364 A [OI] AND 5198 TO 5200 A [NI] LINES IN HIGH AURORAS. Moiseyeva, L. V. (Belorussian State Univ., Minsk). Geomagn. Aeron. (Transl.).; 14: No. 5, 711-713(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 833-836(1974).

The possibility, in principle, of the generation of λ 6300-6364 Å [OI] emission in high auroras is demonstrated. The generation of λ 5198-5200 Å [NI] emission can occur under approximately the same conditions, but at much greater heights. (1 fig, 13 refs) (auth)

23215 CHERENKOV RADIATION AND THE FRONTAL STRUCTURE OF AN ELECTRON BEAM INJECTED INTO THE IONOSPHERE. Karpman, V. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 721-724(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 846-849(1974).

It is demonstrated that the front of a beam is bunched in an "electron echo" experiment. The field of the Cherenkov radiation of a bunched beam is found. An explanation is offered for the observed amplitude maximum at definite pitch angles. (19 refs) (auth)

23216 IONOSPHERIC AND GEOMAGNETIC EFFECTS OF SOLAR ACTIVITY IN AUGUST 1972. Zevakina, R. A.; Goncharova, E. E.; Yudovich, L. A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 698-701(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 816-820(1974).

The disturbances of the F region and of the geomagnetic field on August 1-14, 1972, are analyzed from the data of Soviet stations and compared with the emission of X-rays, energetic protons, and the low energy solar plasma during flares. The parameters of particle fluxes in the ionosphere are determined from the variation of N(h) profiles in Moscow. (3 figs) (auth)

23217 INSTABILITY OF INTERNAL GRAVITY WAVES. Ginzburg, E. I.; Rubinovich, I. M. (Inst. of Geology and Geophysics, Novosibirsk, USSR). Geomagn. Aeron. (Transl.).; 14: No. 5, 683-687(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 797-803(1974).

It is demonstrated that, in principle, the horizontal pressure gradient of the neutral atmosphere may produce an instability of internal gravity waves (IGW) at the levels of the lower ionosphere. This instability is used to explain the predominant scales of vertical wind variations in the lower ionosphere and the propagation characteristics of traveling disturbances in the F region. 21 refs. (auth)

23218 THEORETICAL MODELS OF SEASONAL ELECTRON-DENSITY VARIATIONS IN THE MID-LATITUDE F_2 REGION. I. Fatkullin, M. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 688-691(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 804-808(1974).

The seasonal electron density variations at heights $180 \leq h \leq 600$ km in the mid-latitude F_2 region at low solar activity are investigated by numerically integrating the nonstationary continuity equation for an electron-ion gas. Two models are examined in this part of the study: a diffusion model, taking into account the effect of photoionization, recombination, and ambipolar diffusion on $n_e(h,t)$, and a model taking the physical processes of the diffusion model into account along with the effect of electric fields on the seasonal electron-density variations. These theoretical models are investigated mainly to determine the principal mechanisms of the seasonal anomaly. It is demonstrated that neither model can explain quantitatively the appearance of the seasonal anomaly. (4 figs, 24 refs) (auth)

23219 THEORETICAL MODELS OF THE VERTICAL DISTRIBUTION OF THE DENSITY OF ELECTRONS AND VARIOUS IONIC COMPONENTS IN THE LOWER PART OF THE MID-LATITUDE F REGION DURING NEGATIVE DISTURBANCES. I. Fatkullin, M. N.; Mal'tseva, O. A.; Zelenova, T. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 692-697(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 809-815(1974).

The vertical electron-density distributions in the lower part of the daytime mid-latitude F region during negative disturbances are investigated. A simple photochemical model is considered. The appearance of negative disturbances is ascribed to variations in the neutral composition of the upper atmosphere at turbopause levels during storms. Allowance for neutral composition makes it possible to simulate the main characteristics of the vertical distribution of negative disturbances and the appearance of an F_1 layer during magnetic storms. (4 figs, 25 refs) (auth)

23220 RADIO WAVE PROPAGATION AND IONIZATION OF METEORIC CONSTITUENTS. Sen, A. K.; Saha, B. (Calcutta Univ.). Nature (London).; 255: No. 5506, 313-316(22 May 1975).

A study was made of the effect of meteoric ionization on radio wave propagation characteristics in the low frequency band, where most radio aids for aerial and marine navigation operate. For the purpose the field strength, during daytime, of a radio navigational signal on 280 kHz transmitted from Jessore, India, was monitored over a period of a few years. Results indicated that meteors can produce significant ionization below the ionosphere regions around 85 km that are responsible for the reflection of low frequency signals, causing sizeable radio absorption during major meteor shower activities. Some results are given from a detailed analysis of the data for periods of major meteor showers during June 1972 to May 1973. The receiver used was basically a low noise superheterodyne with band-width 2 kHz and gain 120 dB. Some observations are included on the relation between meteor type and characteristics and ionization. (UK)

23221 INTENSITY DISTRIBUTION OF Pi2 PULSATIONS ALONG THE GEOMAGNETIC MERIDIAN AND ON THE NIGHT SIDE OF THE EARTH. Baranskii, L. N.; Shchepetnov, R. V.; Afanas'yeva, L. T.; Zybin, K. Yu.; Hillebrand, O.; Sanker Harayan, P. V. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (Transl.); 14: No. 5, 743-746(1974).

Translated from Geo. Aeron.; 14: No. 5, 871-875(1974).

It is demonstrated that the main maximum in the spatial distribution of Pi2 intensity is localized in the midnight sector of the southern boundary of the auroral oval and moves along the meridian with this boundary as geomagnetic activity changes. (3 figs, 18 refs) (auth)

23222 SOLAR PARTICLE AND AURORAL-ZONE X-RAY MEASUREMENTS WITH BALLOON-BORNE INSTRUMENTS DURING THE SOLAR PARTICLE EVENTS OF AUGUST 1972. Kremser, G.; Kirsch, E.; Pfotzer, G.; Saeger, K. H.; Specht, H. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz (F. R. Germany). Inst. fuer Stratosphaerenphysik); Riedler, W.; Slamanig, H.; Zirm, K. (Technische Hochschule, Graz (Austria)). SPARMO Bull.; 6: No. 1, 25-65(Dec 1974).

A short description of the payloads and counting rate versus time plots obtained during the August 1972 flights is given. The data obtained are presented in two parts. Part I contains the results of special purpose data reduction; part II, the standard 30 sec-averages of the counting rates plotted versus UT. (FR)

23223 MEASUREMENTS OF AURORAL-ZONE X-RAYS AND AURORAL EMISSIONS WITH BALLOON-BORNE INSTRUMENTS AT KIRUNA IN 1971. Kirsch, E.; Kremser, G.; Pfotzer, G.; Richter, K.; Saeger, K. H.; Specht, H. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz (F. R. Germany). Inst. fuer Stratosphaerenphysik); Riedler, W.; Slamanig, H.; Zirm, K. (Technische Hochschule, Graz (Austria)). SPARMO Bull.; 6: No. 1, 3-23(Dec 1974).

The first part of the balloon campaign of 1971 was planned mainly to measure X-rays with newly developed payloads; part two had the aim to measure simultaneously X-rays and auroral emissions. A short description of the payloads and counting rate versus time plots obtained during the flights is given. (FR)

Magnetospheric Phenomena

Refer also to abstracts 23145, 23185, 23207, and 23221.

23224 (UCRL-76299) ADVANCES IN MAGNETOSPHERIC PHYSICS, 1971-1974: ENERGETIC PARTICLES. West, H. I. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1974. 73p. (CONF-750821-1). Dep. NTIS $6.75.

From American geophysical union meeting; Grenoble, France (24 Aug 1975).

An account is given of energetic particle research in magnetospheric physics for the time period 1971-1974. Emphasis is on relating the various aspects of energetic particles to magnetospheric processes. 458 refs. (auth)

23225 RELATIONSHIP BETWEEN HIGH-LATITUDE DAYTIME GEOMAGNETIC FIELD PULSATIONS (T = 5 TO 10 MIN) AND THE SOLAR WIND PARAMETERS. Bol'shakova, O. V.; Men'shutina, I. N.; Pudovkin, M. I. Antarktika; No. 13, 5-11 (1974). (In Russian).

The relationship between solar wind parameters and long-period day-time pulsations is studied on the basis of IMP-1 data (December 1963 through January 1964) and of magnetograms obtained at the Mirnyi station. It is shown that the pulsation period decreases and the amplitude increases with increasing solar wind velocity. No dependence of the pulsation characteristics on the energy density of the solar wind nor on the particle density of the X- and Y-components of the field was observed. (IAA)

23226 SPECTRAL CHARACTERISTICS OF POLAR IRREGULAR PULSATIONS OF THE GEOMAGNETIC FIELD. Baranskii, L. N.; Mingalev, V. S.; Roldugin, V. K.; Chernous, S. A. Antarktika; No. 13, 12-18(1974). (In Russian).

The amplitude spectra of pip-type pulsations of the three magnetic field components and of the auroral luminosity are plotted on the basis of short-period fluctuations recorded at the Mirnyi observatory. The aurora and field spectra are found to be very similar, the nonmonotone nature of the pip spectra being their characteristic feature. The presence of a large number of peaks is attributed to the fact that pip-type pulsations are a periodic but not a harmonic process. (IAA)

23227 GEOMAGNETIC THRESHOLDS FOR ENERGY PARTICLES IN THE HIGH LATITUDES. Smirnov, V. S.; Medvedev, M. Yu. pp 69-75 of Geomagnitnye I Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Beryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian).

The distribution of the geomagnetic thresholds at high latitudes was studied. The dependence of the geomagnetic thresholds on the latitude was found for model fields of the upper magnetosphere. The comparison of the calculated values of the geomagnetic thresholds with experimental data showed that the energetic particles freely pass from interplanetary space to the interior of the magnetosphere up to distances of the order of 6 to 7 radii of the earth. Possible mechanisms of such passage were discussed. (tr-auth)

23228 PROPAGATION OF HYDROMAGNETIC WAVES IN A THREE-DIMENSIONAL MAGNETOSPHERE. II. Van'yan, L. L.; Sipatov, A. S. (Inst. of Space Research, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 714-716(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 837-840(1974).

A three-dimensional disturbance of the magnetospheric plasma during the advance of a weak, plane solar-wind pressure inhomogeneity toward the magnetopause is analyzed in the magnetohydrodynamic approximation. The configurations of the initial magnetosphere and of the geomagnetic field are selected on the basis of the computations of Mead and Beard. (5 figs.) (auth)

23229 INTERACTION BETWEEN HYDROMAGNETIC WAVES AND THE EARTH'S MAGNETOSPHERE IN THE QUASI-HYDRODYNAMIC APPROXIMATION. Sobolev, S. V. (Inst. of Space Research, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 717-720(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 841-845(1974).

The transfer of the energy of magnetoacoustic waves across the boundary of the magnetosphere, regarded as a plane tangential discontinuity, is investigated in the quasi-hydrodynamic Chew-Goldberger–Low approximation. Expressions are obtained that define the energy density and the energy flux density of small oscillations in this approximation. 15 refs. (auth)

23230 POTENTIAL ELECTRIC FIELD IN THE LOW-LATITUDE IONOSPHERE AND EQUATORIAL ELECTROJET. Gurevich, A. V.; Krylov, A. L.; Fayermark, D. S. (Lebedev Inst. of Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 678-682(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 792-796(1974).

As they approach the geomagnetic equator, the electric field and currents show behavioral singularities associated, first of all, with the geometry of magnetic lines of force and, second, with the vertical distribution of Hall and Pedersen conductivities. These singularities lead to a sharp increase in the current near the geomagnetic equator, to the formation of an equatorial electrojet. The increase in electric field and currents near the geomagnetic equator is produced solely by the geometry of the lines of force and the distribution of conductivity, and is practically independent of the field generation mechanism. (13 refs. 2 figs.) (auth)

23231 DEPENDENCE OF FLUXES OF HIGH-ENERGY CHARGED PARTICLES IN THE EQUATORIAL REGION ON GEOMAGNETIC ACTIVITY. Basilova, R. N.; Volodichev, N. N.; Grigorov, N. L.; Galaktionova, Yu. F.; Kalinkin, L. F.; Pugacheva, G. I.; Savenko, I. A. (Moscow State Univ.). Geomagn. Aeron. (Transl.).; 14: No. 5, 764-765(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 899(1974).

Measurements of the fluxes of high energy electrons and protons were made on the Proton-3 space station from July 6 to September 10, 1966, and the dependence of the high energy particle fluxes on geomagnetic activity were analyzed. Cherenkov counters, coincidence-connected with telescopes consisting of scintillation counters were used to record the fluxes, while electron flux ($\geq$80 MeV) was separately measured by filtering out proton background with a heavy absorber. The average fluxes are given for a magnetically quiet and a disturbed magnetosphere. (GHT)

23232 OBSERVATION OF GEOMAGNETIC PULSATIONS IN THE 0- TO 2-Hz RANGE WITH INTENSE MODULATION OF THE CARRIER FREQUENCY. Gul'el'mi, A. V.; Dovbnya, B. V. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 740-742(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 868-870(1974).

A new type of geomagnetic pulsations, i.e., serpentine emission, is identified in the 0- to 2-Hz range. Its distinctive feature is the intense modulation of the carrier frequency. A hypothesis is advanced of the generation of this type of emission in the solar wind. Frequency modulation is explained by the Doppler shift and by variations in the direction of the interplanetary magnetic field. (3 figs, 10 refs) (auth)

23233 REFERENCE LEVEL OF THE FIELD OF MAGNETIC VARIATIONS IN THE POLAR REGION. Fel'dshteil, Ya. I.; Shevnina, N. F.; Sumaruk, P. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 5, 736-739(1974).

Translated from Geomagn. Aeron.; 14: No. 5, 863-867(1974).

The variations of the Z component at Thule in the course of a year and of a day are examined in relation to the sign of the azimuthal component of the interplanetary magnetic field in the plane of the ecliptic. 3 figs, 14 refs. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 22131 and 22196.

23234 (SAND-75-0368) APPROXIMATION TO THE EXACT SOLUTION FOR RELATIVISTIC SPACE CHARGE LIMITED FLOW IN PLANAR DIODES. Miller, P. A. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jul 1975. Contract AT(29-1)-789. 6p. Dep. NTIS $4.00.

The non-relativistic and ultra-relativistic asymptotic solutions for space-charge limited flow in planar REB diodes have been known for some time. Simple approximations which may be useful for calculational purposes are presented here; one bridges between the two limiting cases in the range 500 keV to 50 MeV with an accuracy of better than 12 percent. (auth)

23235 EFFECT OF SOLID STATE PLASMA OSCILLATION ON ENERGY LOSSES OF ELECTRONS SCATTERED ON THE SURFACE OF Ti, V, AND Cr. Kolodziej, H. B.; Wesolowski, J.; Rozenfeld, B. (Univ., Wroclaw). Acta Phys. Pol., Ser. A.; A47: No. 6, 751-759(Jun 1975).

The method of discrete energy losses of electrons scattered on the plane surfaces of Ti, V and Cr samples has been applied in measurements of the energy of plasma excitations; the electron energy losses have been measured on the polycrystallic high purity samples in vacuum of the order of 10^{-6} torr. Measurements were taken with an electrostatic analyzer recording the energy of the electron beam scattered on the sample's surface at the angle $\theta = 90°$. The spectra of characteristic energy losses obtained this way allow one to expect the existence, in a group of transition d-metals Ti, V and Cr, of two components of volume plasmons corresponding to the excitation of s electrons and d electrons. (auth)

23236 SOURCE OF NEGATIVE IONS. Golubev, V. P.; Nalivaiko, G. A.; Tsepakin, S. G. (Inst. of Scientific-Research of Electrophysical Equipment, Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1272-1274(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 30-32(1974).

A duoplasmatron with a tubular discharge is described which allows pulsed beams of negative H_1^- ions with a current of up to 7 mA to be obtained for an emission current density H_1^- of about 140 mA·cm^{-2}. The normalized emittance of a H_1^- beam at a current of 4 mA does not exceed 0.1 cm·mrad. (auth)

23237 THREE-ELECTRODE HIGH-PERVEANCE ELECTRON GUN FOR DEFINING A TUBULAR BEAM. Zinchenko, N. S.; Sokolova, V. A. (Inst. of Radio Physics and Electronics, Kharkov). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1263-1265(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 23-25(1974).

A description of the equipment and the experimental results are presented for an investigation of a three-electrode electron gun having longitudinal compression. The gun defines a tubular electron beam and has a high perveance. The isocurrent characteristics, the magnitude of the perveance, and the transmission coefficient of the defined beam are presented. For a beam having a current density of 0.4 to 0.5 A/cm^2, the maximum value of perveance is 100 to 120 μA/V$^{\frac{3}{2}}$ for transmission coefficients of 90 to 99%. The measured values of the parameters are compared with the computed values. The dependence of the perveance of the defined beam on the distance between the irises of the gun is investigated. (auth)

23238 ELECTRON GUN WITH A COLD CATHODE FOR PRODUCING CURRENTS OF APPROXIMATELY 10^5 A IN A PULSE. Iremashvili, D. V.; Kuril'nikov, S. V.; Osepashvili, T. A. (Sukhumi Inst. of Physics and Tech., USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 5, 1266-1268(1974).

Translated from Prib. Tekh, Eksp.; 17: No. 5, 26-28(1974).

An experimental installation is described and measurement results are presented for investigations of a high-current pulsed electron gun with a cathode. The gun has a high current-transmission factor (~96%) which allows pulses of electron current having an amplitude of approximately 10^5 A, which are stable in shape and intensity to be obtained at accelerating voltages of 60 kV for pulse lengths of approximately 200 nsec. (auth)

Atomic and Molecular Properties

Refer also to abstracts 22848, 23255, 23257, 23291, 23472, and 23473.

23239 CNDO MO CALCULATIONS FOR HYDROGEN ATOM ADSORPTION ON NICKEL ATOM CLUSTERS. Blyholder, G. (Univ. of Arkansas, Fayetteville). J. Chem. Phys.; 62: No. 8, 3193-3197(15 Apr 1975).

CNDO molecular orbital calculations were done for H atom interactions with various locations on (100), (110), and (111) surfaces of nickel atom clusters containing up to 10 nickel atoms. The CNDO procedure used was basically a modification of that introduced by Pople in which all molecular orbitals are doubly occupied except for the highest-occupied MO, which contains one electron. Equilibrium positions were determined both with respect to distance from the surface and position on the surface. Hydrogen atoms are more stable in multicenter bonds over holes than when directly over a surface atom. The (111) surface produced the greatest binding energy. For the Ni clusters the s and p orbitals of the Ni atoms were primarily responsible for the nickel–hydrogen bonding with the d orbitals playing a relatively minor role. The adsorbed hydrogen atom carries a negative charge. (1 figure, 5 tables) (auth)

23240 OBSERVATION OF BLOCH–SIEGERT SHIFTS IN THE $2^2S_{\frac{1}{2}}-2^2P_{\frac{1}{2}}$ MICROWAVE RESONANCE IN ATOMIC HYDROGEN. Andrews, D. A.; Newton, G. (Univ. of Sussex, Brighton, Eng.). J. Phys., B (London); 8: No. 9, 1415-1419(21 Jun 1975).

Radio-frequency power shifts in the $2\,^2S_{\frac{1}{2}}-2\,^2P_{\frac{1}{2}}$ microwave resonance in atomic hydrogen have been measured and compared with the results of a numerical integration for the two- and three-level situations. Effects due to the initial phase of the RF field, the finite size of the atomic beam and its trajectory have been included in the numerical integration. (auth)

23241 MEASUREMENT OF STARK BROADENED LYMAN-LINES. Fussmann, G. (Bochum Univ., Ger.). J. Quant. Spectrosc. Radiat. Transfer.; 15: No. 9, 791-809(Sep 1975).

Stark broadened profiles of the hydrogen Lyman-lines Ly-α to Ly-ϵ have been measured in a wall-stabilized argon arc, providing a plasma of an electron density of 7.2×10^{16} cm^{-3} and a temperature of 12,200 K. In the cases of Ly-α and Ly-β, detailed investigations of the profiles are performed including absolute measurements, measurements of line shifts and asymmetries and comparisons with modern theories. Moreover, a comprehensive discussion of experimental errors is given and some important features of the radiation source are outlined. (auth)

23242 INCOHERENT SCATTERING OF GAMMA RAYS BY INNER-SHELL ELECTRONS. Schumacher, M.; Smend, F.; Bochert, I. (Univ., Goettingen, Ger.). J. Phys., B (London); 8: No. 9, 1428-1439(21 Jun 1975).

Using the form factor approximation and nonrelativistic Coulomb wavefunctions, cross section profiles for Compton scattering of γ rays are calculated for all subshells of the atom. Spherical coordinates are used in order to facilitate a straightforward application of self-consistent wavefunctions. Relativistic energy and momentum relations are applied. Numerical data are presented for $E_\gamma = 279$ keV and the K-, L- and M-subshells of copper and lead. Comparisons are made with cross section profiles obtained by replacing the final-state Coulomb wavefunction by a plane wave. Reasonable agreement between the two methods of calculation has been found for the L- and M-shells of copper for energies close to the center of the profile. Larger differences occur for the K-shell of copper and the K-, L- and M-shells of lead even close to the centers of the profiles. Secondary maxima occur which are related to the nodes in the bound-state wavefunctions. In agreement with previous measurements, these secondary maxima do not show up in the sum of cross section profiles of the K-, L- and M-shells. The possibility of obtaining information on the wavefunctions close to the nucleus from the high-energy part of the cross section profile is discussed. (auth)

23243 TENTATIVELY IDENTIFIED AND PREDICTED H^- FANO RESONANCE. Ingemann-Hilberg, C. (Univ. of Aarhus, Denmark); Rudkjoebing, M. J. Quant. Spectrosc. Radiat. Transfer.; 15: No. 9, 823-830(Sep 1975).

Positions are calculated for the Fano resonances that are due to interactions of the discrete autoionized 1s3s, 1s3p, and 1s4p states of H^- with overlapping split-configuration continua. The two first-mentioned resonances are tentatively identified with the diffuse interstellar doublets at λλ6376,6379 and λλ5780,5797 on the basis of the relative positions of the autoionized states and the relative intensities of the doublet components. The observed wave-numbers of the 1s2s, 1s3s, 1s2p and 1s3p resonances seem to belong to two series that converge towards a common limit in a kind of reverse Rydberg-series fashion. The position

of the limit is close to 9000 Å, in accordance with theory. An extrapolation leads to the identification of the 1s4p resonance with the diffuse λ6614 line. A further extrapolation leads to the prediction of positions at about 7183 and 7583 Å for the 1s5p and 1s6p resonances. The half-widths calculated for the singlet components of the 1s3p and 1s4p resonances are of the order of magnitude of those observed for the diffuse lines, and of the observed distance between the probably partly mixed singlet and triplet 1s3p components. The profile of the λ 5780 resonance is calculated on the basis of an assumed helium-line value for the oscillator strength. Its shape indicates that the "λ5778 band" may be just a misinterpretation of the asymmetric wings. Tables of Hartree functions for the $3s^2$, $3p^2$ and $4p^2$ configurations of H^- are given in an appendix. (auth)

23244 CORRECTIONS TO COUPLED HARTREE–FOCK THEORY: THE REARRANGEMENT EFFECT. Bhattacharya, A. K.; Moitra, R. K.; Mukherji, A. (Saha Inst. of Nuclear Physics, Calcutta). Int. J. Quant. Chem.; 9: No. 3, 385-392(May 1975).

In this communication a method of incorporating corrections to the coupled Hartree–Fock (CHF) formalism by introducing the so-called "rearrangement effect" is introduced. In this, the relaxation of the core orbitals is considered when excitations from a starting Hartree–Fock wave function occur. The magnitude of this correction numerically is found to be quite significant for the polarizabilities of two-electron atomic systems, results for which are reported. (auth)

23245 EXCITATION TRANSFER, LIFETIMES, AND SATELLITE BANDS IN Cs(7p)-Xe COLLISIONS. Kielkopf, J. F. (Argonne National Lab., IL). J. Chem. Phys.; 62: No. 12, 4809-4814 (15 Jun 1975).

Observation of the time-dependence of excitation transfer between Cs 7p ^{2}P/sub 1/2/ and ^{2}P/sub 3/2/ levels caused by collisions with xenon are reported. The ^{2}P levels were selectively excited with an N_2 laser-pumped dye laser, and the spectrum of the fluorescence radiation was observed with 5 nsec time resolution. The lifetimes of the levels were found to be (^{2}P/sub 1/2/) 154 ± 2 nsec and (^{2}P/sub 3/2/) 135 ± 2 nsec, and the ^{2}P/sub 1/2/ to ^{2}P/sub 3/2/ transfer cross section at 325 ± 10°K is 0.150 ± 0.002 A^2. An analysis of the time-dependent decay versus xenon partial pressure shows that the cross section for quenching or collision induced radiation is less than 4×10^{-3} A^2. This demonstrates that collision induced transitions cannot be important in the formation of near red satellites on the Cs 6s–7p lines perturbed by Xe. In addition, the radiative decay constant for the satellite is identical to that for the line within experimental uncertainty. The correspondence of satellite and line decay curves provides a method of identifying satellites with their parent line. (5 figs, 27 refs) (auth)

23246 IONIZATION WAVES (MOVING STRIATIONS) IN A LOW PRESSURE HELIUM DISCHARGE: RESULTS OF MEASUREMENTS COMPARED WITH A DIRECT SOLUTION OF THE ELECTRON BOLTZMANN EQUATION. Perina, V.; Rohlena, K.; Ruzicka, T. (Inst. of Physics, Prague). Czech. J. Phys.; 25: No. 6, 660-676(1975).

The Boltzmann equation expanded in the angular dependence in the velocity space is solved numerically in one-dimensional approximation to obtain the perturbed distribution function. This perturbed distribution is integrated to construct the rate coefficients entering the atomic ion and the metastable continuity equations. From these balance equations the dispersion equations of the fast as well as slow ionization wave varieties are recovered. The space resonances of the electron gas described earlier give rise to the fast s and slow s′ wave varieties observed in the positive column of the low current helium DC discharge. The existence regions of these waves are numerically evaluated and compared with experiment. Furthermore, the results on the wave phase velocities and dependence of the characteristic potential on the electric field are confronted with the experimental data. The theory, which involves no free or adjustable parameters renders a reasonable agreement in some points. Possible reasons for the observed discrepancies are also discussed. (auth)

23247 DETERMINATION OF THE ISOTOPIC SHIFT OF ^{192}Hg IN THE LINE λ = 2.537 Å BY ZEEMAN SCANNING THE HANLE SIGNAL. Huber, G.; Kluge, H. J.; Kugler, L.; Otten, E. W. (Heidelberg Univ. (F. R. Germany). 1. Physikalisches Inst.; European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration). Z. Phys., A; 272: No. 4, 381-385(1975).

The Hanle signal in the λ = 2,537 Å resonance line of a line mass separated ^{192}Hg was Zeeman scanned from a spectral lamp containing isotopically pure ^{204}Hg. The isotopic shift was redetermined as $\delta\nu^{192/204} = \nu^{204} - \nu^{192} = -27.7(3)$ GHz. The application of this method to even-even isotopes still further from stability is discussed. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

23248 (COO-3496-50, pp 81-90) MUON LIFETIME MEASUREMENTS IN THE ACTINIDE ELEMENTS. Hensley, W. K. (Los Alamos Scientific Lab., N. Mex.); Huizenga, J. R.; Perry, D. G.; Browne, J. C.; Kalbach, C. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23249 EMISSION OF THE AUGER ELECTRONS IN MUONIC ATOMS AND ESCAPE OF CHARGED PARTICLES AT μ^--MESON CAPTURE BY LIGHT (C, N, O) AND HEAVY (Ag, Br) NUCLEI. Batusov, Yu. A.; Bunyatov, S. A.; Vizireva, L.; Gulkanyan, G. R.; Mirsalikhova, F.; Sidorov, V. M.; Chernev, Kh. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1215-1219(Jun 1975). (In Russian).

Emission probabilities for the Auger electrons with energies 20–100 keV in muonic atoms of light (C, N, O) and heavy (Ag, Br) elements are determined: $\alpha^l = (1.1 \pm 0.3) \cdot 10^{-2}$, $\alpha^h = (31 \pm 1) \cdot 10^{-2}$. The multiplicity is determined and the Auger electron spectrum is measured for the muonic heavy atoms. The relative probabilities are obtained for escape of one, two, three and four charged particles at μ^--meson capture by nuclei C, N, O and Ag, Br. The total yield of charged particles per a capture event is (7.4 ± 1.4)% for the nuclei C, N, O and (2.9 ± 0.2)% for the nuclei Ag, Br. (4 tables) (auth)

23250 MOMENTUM DENSITY MEASUREMENTS BY POSITRON ANNIHILATION IN METALS AND ALLOYS. Recent Experiments with a Multicounter Two-Dimensional Angular Correlation Apparatus. Berko, S.; Mader, J. (Brandeis Univ., Waltham, Mass. (USA)). Appl. Phys.; 5: No. 4, 287-306(Jan 1975).

From 3rd international conference on positron annihilation; Otaniemi, Finland (7 Aug 1973). 15 figs.; 92 refs.

The technique of positron annihilation as applied to the study of momentum densities and Fermi surfaces is reviewed. The angular correlation of the two annihilation photons is directly related to the momentum distribution of the positron-electron system; breaks in this distribution reveal the size and shape of the Fermi surface. After a general introduction to the theory and the experimental techniques used, the results yielding various features of the Fermi surface in high concentration disordered alloys are reviewed, and are compared with theoretical predictions. A new multicounter two-dimensional correlation apparatus is described, and results in several solids are presented. (auth)

Collision Phenomena

Refer also to abstracts 23242 and 23245.

23251 (ANL-75-3-PI) RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT: RADIATION PHYSICS, JULY 1973–JUNE 1974. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 136p. Dep. NTIS $5.45.

Subjects covered include: theories of primary yields, secondary electron spectra, collisions of fast charged particles, photoionization processes, low energy electron collisions, and energy transfer from an excited species to another molecule. Separate abstracts were prepared for the articles. (GHT)

For abstracts of individual papers see: 23252–23259, and 23291.

23252 (ANL-75-3-PI, pp 1-15) THEORY OF THE IONIZATION YIELD IN GASES UNDER ELECTRON IRRADIATION. Inokuti, M. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The total number N/sub 1/(T) of ionizations that an incident electron of kinetic energy T causes in a pure gas obeys an integral equation known as the Fowler equation. Its solution is shown to closely approximate N/sub 1/(T) equals (T – U)/W/sub a/ for T exceeding several multiples of the first ionization energy I, where U and W/sub a/ are constants having the energy dimension. Simple formulas express U and W/sub a/ in terms of various cross sections for electron inelastic collisions with a gas molecule. In particular, U = I represents the average kinetic energy of a subionization electron. (35 refs) (auth)

23253 (ANL-75-3-PI, pp 16-24) SYSTEMATICS OF THE IONIZATION YIELD IN MONATOMIC GASES UNDER ELECTRON IRRADIATION. Inokuti, M.; Dehmer, J. L.; Saxon, R. P. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The Fano theory and the theory of Fowler-Nordheim are applied to all atoms in the first two rows of the periodic table. Results show significant systematics hitherto little explored. (21 refs, 2 figs) (auth)

23254 (ANL-75-3-PI, pp 37-40) ELECTRON ENERGY-LOSS SPECTROMETER. Progress Report II. Huebner, R. H.; Spence, D.; Steingraber, O. J. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The operational characteristics of the electron energy-loss spectrometer have been studied. Preliminary electron energy-loss spectra for molecular nitrogen have been obtained at several scattering angles. (2 figs.) (auth)

23255 (ANL-75-3-PI, pp 88-90) PRELIMINARY RESULTS ON APPLICATION OF THE MULTIPLE-SCATTERING TECHNIQUE TO ELECTRON–MOLECULE SCATTERING AND MOLECULAR PHOTOIONIZATION: THE PI/sub g/ RESONANCE IN e-N_2 SCATTERING. Dehmer, J. L.; Dill, D. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

A prototype calculation of the well-known 2.5-eV shape resonance in e-N_2 scattering was performed to test the usefulness of the multiple-scattering method for electronic continuum molecular wavefunctions. The results of this demanding test are very encouraging. (auth)

23256 (ANL-75-3-PI, pp 97-98) ELFCTRON CORRELATION EFFECTS NEAR THRESHOLD FOR ELECTRON-IMPACT IONIZATION OF HELIUM. Spence, D. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The total intensity of electrons inelastically scattered from helium was measured as a function of both incident and final energies near the ionization threshold, using a modification of the trapped electron technique. (GHT)

23257 (ANL-75-3-PI, pp 105-109) ROTATIONAL EFFECT IN THE IONIZATION OF A HIGHLY EXCITED ATOM BY COLLISION WITH A POLAR MOLECULE. Matsuzawa, M. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

If the collisional ionization is chiefly due to energy transfer from the polar-molecule rotation to an electron in a high Rydberg state of the atom, then theory predicts that the cross section averaged over a thermal distribution of rotational states should show step-like structure as a function of the energy of the Rydberg state. This structure has been experimentally detected, and it can be considered as direct evidence of the rotational effect in the collisional ionization. (auth)

23258 (ANL-75-3-PI, pp 110-117) IONIZATION OF A MERCURY ATOM BY COLLISION WITH AN EXCITED ARGON MOLECULE. Matsuzawa, M. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The cross section for the ionization process $Ar_2^*(1250\ A) + Hg$ yields $2Ar + Hg^+ + e$ is evaluated by the use of data on the photoionization of a mercury atom and on the emission spectra of an excited argon molecule. (auth)

23259 (ANL-75-3-PI, pp 124-125) LOW-ENERGY PHASE SHIFTS IN THE SUTHERLAND MODEL FOR THE Li SCATTERING. Krishna, V. S.; Tani, S. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Some numerical results that illustrate effects of barrier penetration and orbiting are presented. (auth)

23260 (CEA-CONF-3030) VELOCITY DEPENDENCE OF THE PENNING AND ASSOCIATIVE IONIZATION CROSS SECTIONS OF Ar ATOMS BY He(2^3S) AND He(2^1S) ATOMS. Pesnelle, A.; Watel, G.; Manus, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91— Gif-sur-yvette (France). Service de Physique Atomique). 1975. 1p. (CONF-750474-1). Dep. NTIS (US Sales Only) $4.00.

From 7th national atomic and molecular physics conference; Edinburgh, UK (8 Apr 1975).

The velocity dependence of the cross sections for both Penning and associative ionization of Ar atoms by He metastable atoms, and of their sum, was measured in the energy range 30 to 400 MeV in a crossed-beam experiment. The relative cross sections, clearly showing a difference in reaction mechanism, are compared with theory. (RWR)

23261 (ORO-4325-13) IONIZATION PHENOMENA. Progress Report, 1 December 1974–31 July 1975. Watson, R. L. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.). 1975. Contract AT(40-1)-4325. 52p. Dep. NTIS $5.75.

Research discussed in this report was concerned primarily with studies of L-shell lifetime effects on Kα x-ray satellites produced in heavy-ion–atom collisions, L-subshell ionization by alpha particles, and many-body effects in x-ray photoelectron and Auger electron emission from As and some of its compounds. Papers with a significant amount of information are listed separately by title. (RWR)

For titles of individual papers see: 23262–23265.

23262 (ORO-4325-13, pp 5-18) L-SHELL IONIZATION OF INTERMEDIATE- AND HIGH-Z ELEMENTS BY ALPHA PARTICLES. Hardt, T. L.; Watson, R. L. 1975.

In Ionization phenomena. Progress report, 1 December 1974–31 July 1975. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.).

23263 (ORO-4325-13, pp 18-27) PROGRAM ORION. Hardt, T. L. 1975.

In Ionization phenomena. Progress report, 1 December 1974–31 July 1975. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.).

23264 (ORO-4325-13, pp 32-36) L-VACANCY LIFETIME EFFECTS ON K alpha X-RAY SATELLITES PRODUCED IN HEAVY-ION–ATOM COLLISIONS. Watson, R. L.; Chiao, T.; Jenson, F. E.; Sonobe, B. I. 1975.

In Ionization phenomena. Progress report, 1 December 1974–31 July 1975. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.).

23265 (ORO-4325-13, pp 36-42) SYSTEMATICS OF SINGLE K- PLUS MULTIPLE L-SHELL IONIZATION IN HEAVY-ION–ATOM COLLISIONS. Watson, R. L.; Chiao, T.; Jenson, F. E.; Sonobe, B. I. 1975.

In Ionization phenomena. Progress report, 1 December 1974–31 July 1975. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.).

23266 (UCRL-51889) APPLICATION OF NONLINEAR OPTICAL TECHNIQUES FOR THE INVESTIGATION OF MOLECULAR PROPERTIES AND COLLISIONAL PROCESSES. Bischel, W. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1975. Contract W-7405-Eng-48. 295p. Dep. NTIS $7.60.

Thesis.

Molecular collisional processes were studied by using two different nonlinear optical techniques utilizing CO_2 lasers. The first study used the techniques of saturation spectroscopy to study the momentum transfer in one direction which occurs when CO_2 collides with itself, H_2, Ne, NH_3, and CH_3F. Average CO_2 velocity changes determined from these experiments were typically $1/10$ the thermal velocity or less. A theoretical model was also developed to explain the experimental observations of CO_2 with foreign gas perturbers. Generally good agreement between this model and the data was obtained. The second technique utilized the high-resolution capabilities of Doppler-free two-photon absorption (DFTPA) for the study of molecular properties and collisional processes in the two molecules CH_3F and NH_3. The first observation of DFTPA in molecular systems using two fixed-frequency CO_2 optical fields in combination with molecular Stark tuning is reported. The pressure broadening coefficient and the pressure shift of the O yields nu_3 transition were measured; broadening coefficients for the foreign gas perturbers of He and CF_3I were determined. A self-broadening coefficient of the O yields $2nu_2$ transition was also measured; foreign gas broadening coefficients for the collision partners H_2, D_2, He, Ne, and Xe were determined. Spectroscopic information was also obtained about these two molecular systems. (62 figures, 33 tables, 182 references) (RWR)

23267 TWO-ATOM ION-ELECTRON RECOMBINATION RATE AS A FUNCTION OF TEMPERATURE. Vlaskov, V. A. pp 33-41 of Geomagnitnye I Ionosfernye Vozmushcheniya V Vysokikh Shirotakh. Bryunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The process of dissociative recombination of two-atom ions with electrons and its dependence on temperature were examined. It was assumed that the temperature of the electrons and ions is similar. In the adiabatic approximation an analytical expression was obtained for the temperature dependence of the rate of dissociative recombination. The theoretical results were compared with experimental results. (tr-auth)

23268 ION–MOLECULE REACTIONS IN Ar AT 296, 195, AND 77°K. Liu, W. C. F.; Conway, D. C. (Texas A and M Univ., College Station). J. Chem. Phys.; 62: No. 8, 3070-3073 (15 Apr 1975).

Ion–molecule reactions were studied at 296 and 195°K in Ar gas which was purified by passage through a Ti furnace. The rate constant k_1 for the reaction, $Ar^+(^2P/sub\ 3/2/) + 2Ar$ yields $Ar_2^+ + Ar$, was measured in a drift tube at pressures reduced to 0°C (P_0) of 1.414 to 3.00 torr. Ions effused from the drift tube and were counted with a TOF mass spectrometer. k_1 was corrected for side reactions with impurities and found to be $(2.3 \pm 0.2) \times 10^{-31}$ and $(3.0 \pm 0.2) \times 10^{-31}$ cm⁶/sec at 296 and 195°K, respectively. It appears that Ar^+ in the $^2P/sub\ 1/2/$ state does not form Ar_2^+ at these temperatures. An upper limit to the rate constant for the reaction $Ar^+(^2P/sub\ 1/2/) + Ar$ yields $Ar^+(^2P/sub\ 3/2/) + Ar +$ energy was observed to be 2×10^{-16} cm³/s at 296°K. At 77°K both states of Ar^+ appear to form Ar_2^+ with a rate constant of $5.2 \pm 0.1) \times 10^{-31}$ cm⁶/sec. The rate of formation of Ar_2^+ and the equilibrium between Ar_2^+ and Ar_4^+ were also studied at 77°K. (2 figures, 3 tables) (auth)

23269 GAS PHASE EPR LINEWIDTHS AND INTERMOLECULAR POTENTIALS. III. Experimental Results for the F–Ar, Cl–He, and Cl–Ar Systems. Zegarski, B. R.; Cook, T. J.; Miller, T. A. (Bell Telephone Labs., Inc., Murray Hill, NJ). J. Chem. Phys.; 62: No. 8, 2952-2956(15 Apr 1975).

Previous linewidth measurements on the gas phase EPR spectral lines of the F atom perturbed by He were extended to include the collision pairs, F–Ar, Cl–He, and Cl–Ar. The new results share with the F–He data the feature that different Zeeman transitions in the $^2P/sub\ 3/2/$ state have different broadening cross sections. Also, in all cases the $^2P/sub\ 1/2/$ cross section is two or more orders of magnitude smaller than the $^2P/sub\ 3/2/$ cross sections. Comparison of the $^2P/sub\ 3/2/$ cross sections for the collision partners indicates that the angular symmetry of the intermolecular potential is the same for all; however, the lighter partners He and F have larger cross sections than are predicted by a simple dispersive force model. Evidence is presented which indicates that the $^2P/sub\ 1/2/$ cross sections are dominated by nonadiabatic collisions, which connect the $^2P/sub\ 1/2/$ and $^2P/sub\ 3/2/$ levels. (3 tables) (auth)

23270 THEORETICAL ELECTRON–ATOM ELASTIC SCATTERING CROSS SECTIONS: SELECTED ELEMENTS, 1 keV TO 256 keV. Riley, M. E.; MacCallum, C. J.; Biggs, F. (Sandia Labs., Albuquerque, NM). At. Data Nucl. Data Tables.; 15: No. 5, 443-476(May 1975).

Calculated differential elastic electron scattering cross sections for 24 selected elements are presented in tabular form in the energy range 1 to 256 keV at values of 2/sup n/ keV. The total elastic and momentum-transfer cross sections are tabulated also. Parameters for 12-parameter analytic fits to the differential values are given for 80 elements in a second table. The calculations were done in the relativistic static approximation with relativistic atomic wave functions for the heavier elements (Z greater than 35). (2 figures, 2 tables) (auth)

23271 RATE CONSTANTS FOR THE REACTIONS OF $O_2^+(a\ ^4PI/sub\ u/)$ IONS WITH N_2, Ar, CO_2, H_2, AND O_2 AT RELATIVE KINETIC ENERGIES 0.04–2 eV. Lindinger, W.; Albritton, D. L.; McFarland, M.; Fehsenfeld, F. C.; Schmeltekopf, A. L.; Ferguson, E. E. (Aeronomy Lab., Boulder, CO). J. Chem. Phys.; 62: No. 10, 4101-4110(15 May 1975).

Rate constants for the reaction of $O_2^+(a\ ^4PI/sub\ u/)$ metastable ions with N_2, Ar, CO, CO_2, H_2, and O_2, which do not react with $O_2^+(X\ ^2PI/sub\ g/$, nu equals 0) ground-state ions, were measured for the relative kinetic energies 0.04 to 2 eV in a flow-drift tube. With the exception of O_2 and CO, most of the rate constants are near the respective Langevin limits. The rate constant for the reaction with CO exhibits a pronounced minimum at 0.3 eV; the other reactions show much less variation with energy. Up to 2 eV, quenching of the a $^4PI/sub\ u/$ metastable state to the $X\ ^2PI/sub\ g/$ ground state of O_2^+ appears to be small compared to the reactive losses of $O_2^+(a\ ^4PI/sub\ u/)$ ions. The reactive process is charge transfer, except for CO and H_2. For CO, CO^+ and CO_2^+ are formed roughly in the ratio 5:1; and for H_2, only O_2H^+ is formed. (13 figures, 1 table) (auth)

23272 COLLISIONS BETWEEN ELECTRONS AND H_2^+ IONS. VI. Measurements of Cross Sections for the Simultaneous Production of H^+ and H^-. Peart, B.; Dolder, K. T. (Newcastle upon Tyne Univ., Eng.). J. Phys., B (London); 8: No. 9, 1570-1574(21 Jun 1975).

Inclined beams of electrons and H_2^+ ions have been used in an experiment to measure cross sections for the reaction $e + H_2^+ \rightarrow H^+ + H^-$. The cross section was found to fall from 4.9×10^{-18} cm² at 0.4 eV to 1.16×10^{-18} cm² at 4.96 eV and systematic errors of the measurement were assessed to be less than ±8%. An ion source was used which produced H_2^+ with the vibrational population measured by von Busch and Dunn (Phys. Rev.; A5: 1726-43 (1972)). The results are discussed and compared with theoretical predictions by Dubrovskii and Ob'edkov (Proc. 5th Int. Conf. on Physics of Electronic and Atomic Collisions, Leningrad p 342-5 (1967)). (auth)

23273 RESONANCES AND THEIR EFFECTS ABOVE AND BELOW THE ELECTRON-IMPACT IONIZATION THRESHOLD OF H_2. Weingartshofer, A.; Clarke, E. M.; Holmes, J. K.; McGowan, J. W. (Saint Francis Xavier Univ., Antigonish, Nova Scotia, Canada). J. Phys., B (London); 8: No. 9, 1552-1569 (21 Jun 1975).

An extensive programme is presently underway to study H_2 by electron impact in the energy region near ionization. Two types of spectra obtained with low energy bombarding electrons which have an energy resolution of 40 meV (FWHM) are presented. The energy loss spectrum obtained in the forward direction (10°) with E_i = 25 eV electrons shows a series of unresolved peaks that agree well with the Rydberg states D, D′, D″, . . . and B, B′, B″, . . . and especially with photoionization data. Complementing this, the threshold excitation spectrum of H_2 shows a simpler structure which agrees well with the following series of triplet states: c $^3\Pi_u$, e $^3\Sigma_u^+$, g $^3\Sigma_g^+$, d $^3\Pi_u$, k $^3\Pi_u$ and n $^3\Pi_u$. It was observed that most of these states have a very large and sharp excitation cross section at threshold which has its origin in several series of resonances lying within 30 MeV of these triplets. The angular behavior of the threshold excitation spectra is discussed and absolute differential cross sections for the c $^3\Pi_u$ (v = 1) states are reported as a typical example. The vibronic states of the triplets d $^3\Pi_u$ and k $^3\Pi_u$ that lie above the ionization threshold play an important role in the electron-impact ionization process. Evidence is presented that autoionizing states prefer to decay into the nearest H_2^+ vibration level. (auth)

23274 DIFFERENTIAL SCATTERING OF He^{2+} FROM He. Chen, Y. H.; Johnson, R. E.; Humphris, R. R.; Siegel, M. W.; Boring, J. W. (Univ. of Virginia, Charlottesville). J. Phys., B (London); 8: No. 9, 1527-1543(21 Jun 1975).

Absolute cross sections, differential in angle and energy of the scattered particles, are obtained for single charge transfer and elastic scattering of He^{2+} from He for incident ion energies 200 eV to 600 eV and lab angles 2.5° to 20°. No ground state He^+ are found and oscillations due to double charge transfer are observed in the elastic channel. These data are interpreted in terms of $^1\Sigma_g^+$, and $^1\Sigma_u^+$ potentials in the incident channel and curve crossings of this $^1\Sigma_g^+$ potential with higher states. (auth)

23275 DIABATIC AND ADIABATIC REPRESENTATIONS IN He^+–He CHARGE EXCHANGE COLLISIONS. Bhattacharyya, S. S.; Dastidar, T. K. R. (Indian Association for Cultivation of Science, Calcutta). J. Phys., B (London); 8: No. 9, 1522-1526 (21 Jun 1975).

The utility of the adiabatic and the diabatic representations in molecular eigen-function expansions for He^+–He charge exchange scattering has been considered. The charge transfer probability and cross section have been calculated in both representations over a wide energy range in the uncoupled approximation. Comparison with experiments above 1 keV shows good agreement with the uncoupled diabatic calculations, but a few features appear which are expected to be due to coupling between the two crossing $^2\Sigma_g$ states of the quasi-molecule. (auth)

23276 COLLISION-INDUCED MULTIPHOTON EXCITATION OF HYDROGEN. Choudhury, B. J. (Univ. of Manitoba, Winnipeg). J. Phys., B (London); 8: No. 9, 1420-1427(21 Jun 1975).

The electron impact excitation of hydrogen in the presence of an electromagnetic field has been formulated within the framework of the Glauber approximation. For a low frequency EM field, the cross section formula takes a simple analytic form analogous to the one discussed by Kroll and Watson for the case of potential scattering. Numerical results are given for 1s to 2p excitation and results are compared with those obtained by the first Born approximation. (auth)

23277 CORRECTION OF DIFFERENTIAL CROSS SECTIONS FOR FINITE ANGULAR RESOLUTION. von Busch, F. (Univ., Bonn). J. Phys., B (London); 8: No. 9, 1440-1452(21 Jun 1975).

The angular resolution of a differential scattering apparatus of

the common type is investigated. The primary and scattered beam are each assumed to be non-parallel and collimated by two arbitrary rectangular apertures. A function $\eta(\theta,\Theta)$ describing the acceptance of the apparatus for particles scattered at laboratory angle θ is derived, which connects the directly measurable angular distribution $\dot{N}(\Theta)$ with the differential cross section $\sigma(\theta)$. The two cases of a gas cell target and a locally defined target, such as an atomic or molecular beam, are both treated.(auth)

23278 FREE-FREE ABSORPTION COEFFICIENT OF THE NEGATIVE HELIUM ION. Bell, K. L.; Kingston, A. E.; McIlveen, W. A. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 9, 1453-1458(21 Jun 1975).

Analytic approximations for the evaluation of matrix elements in free-free absorption are examined and assessed by comparison with accurate results. It is shown that satisfactory approximations can be obtained for s ⟷ p and p ⟷ d transitions and these are then employed to evaluate the free-free absorption coefficient for the negative helium ion. The results are expected to be accurate to better than 20%. (auth)

23279 LOW ENERGY SCATTERING OF ELECTRONS BY HELIUM ATOMS. Berrington, K. A.; Burke, P. G.; Sinfailam, A. L. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 9, 1459-1473(21 Jun 1975).

The R-matrix method is used to solve equations describing the scattering of electrons by helium atoms for incident energies near the n = 2 thresholds. The 1^1S, 2^3S, 2^1S, 2^3P and 2^1P target eigenstates, which are included in the expansion of the total wavefunction, are represented by configuration-interaction wavefunctions. In addition ^1P and ^1D pseudostates are retained in some of the calculations. Elastic and inelastic scattering cross sections are calculated and are compared with experiment and with other theories wherever possible. Particular attention is paid to resonances and cusps which dominate the cross sections in this energy region. (auth)

23280 APPROXIMATION OF MULTI-CENTRE INTEGRALS ARISING IN PROTON-HYDROGEN CHARGE EXCHANGE CALCULATIONS. Anderson, D.G.M. (Harvard Univ., Cambridge, MA); Antal, M. J. J. Phys., B (London); 8: No. 9, 1507-1512 (21 Jun 1975).

A lg-magnitude phase representation is used to effect the efficient approximation of multi-center integrals through polynomial interpolation. When the multi-center integrals are evaluated by numerical quadrature, computation costs can be reduced by an order of magnitude or more. (auth)

23281 FOUNDATIONS OF THE TRIPLE CENTRE APPROXIMATION. Antal, M. J. (Los Alamos Scientific Lab., NM); McElroy, M. B.; Anderson, D.G.M. J. Phys., B (London); 8: No. 9, 1513-1521(21 Jun 1975).

A model for the mechanism of charge exchange is proposed. This model motivates the triple-center expansion and predicts which basis states are needed to adequately model a charge-changing reaction. (auth)

23282 SECONDARY ELECTRONS EJECTED FROM He BY PROTONS AND ELECTRONS. Kim, Y. K.; Noguchi, T. (Argonne National Lab., IL). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 77-82(Apr 1975).

Experimental data on the energy distribution of secondary electrons ejected from He by fast protons and electrons are shown to exhibit the following features expected from the Rutherford theory and the Born approximation: (a) the energy distribution of slow secondary electrons resembles in shape that deduced from the photoionization cross-section. (b) The energy distribution for fast secondary electrons converges to that predicted by the Rutherford theory for proton impact and by the Mott theory for electron impact. (c) The cross-sections for fast protons are very similar to those for electrons with the same velocity as the protons. Comparison with the optical data indicates that some minor but systematic corrections on the experimental data are necessary. The corrected experimental data are consistent with the total ionization cross-section. (auth)

23283 TOTAL CROSS-SECTIONS FOR INELASTIC SCATTERING OF CHARGED PARTICLES BY ATOMS AND MOLECULES. VII. Systematics for Atoms in the First and Second Row. Inokuti, M.; Saxon, R. P.; Dehmer, J. L. (Argonne National Lab., IL). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 109-120(Apr 1975).

The Bethe theory gives an asymptotic formula for the total cross-section σ_{tot} for inelastic scattering of fast charged particles. For a (structureless) particle of charge Ze and (non-relativistic) velocity v, it is written as $\sigma_{tot} = 4\pi a_0^2 z^2(R/T) M_{tot}^2 \ln(4c_{tot}T/R)$, where R is the Rydberg energy, a_0 is the Bohr radius and $T = \frac{1}{2}mv^2$, m being the electron mass. Two quantities, M_{tot}^2 and $\ln c_{tot}$, depend upon the internal dynamics of the atom. Comprehensive calculations of these quantities have been performed for neutral atoms He through Ar by use of independent-particle models, and the influence of electron correlations for several atoms has been studied. The calculations reveal certain systematics of M_{tot}^2 and $\ln c_{tot}$ as functions of the atomic number Z. Because M_{tot}^2 is expressed as the ground-state expectation value of the squared sum of atomic-electron coordinates, the trend of M_{tot}^2 follows the size of the atom, governed by its shell structure. The quantity $\ln c_{tot}$ also varies with the atomic size, but within a fairly modest range. Hence, the variation of σ_{tot} at fixed v from one atom to another is chiefly governed by M_{tot}^2. (auth)

23284 SUPEREXCITED STATES OF MOLECULES PRODUCED BY ELECTRON IMPACT. de Heer, F. J. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). Int. J. Radiat. Phys. Chem.; 7: No. 2/3, 137-153(Apr 1975).

New experimental results are presented concerning superexcited states of molecules obtained by means of electron impact on simple hydrocarbons and water and their relation to photoabsorption experiments. Two types of electron experiments are discussed. First, attention is given to excited molecular states dissociating into excited molecular and atomic fragments which are observed by the emitted radiation. Secondly, small angle inelastic scattering of electrons is considered in which their energy loss is measured, alone or in coincidence with the electrons or ions formed. (auth)

23285 ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR ELASTIC SCATTERING OF ELECTRONS BY KRYPTON AND NEON. Jansen, R. H. J.; de Heer, F. J. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 81-112 of Elastic Scattering of Electrons by Noble Gas Atoms and Nitrogen Molecules. Jansen, R. H. J. (ed.). Amsterdam; Amsterdam Univ. (7 May 1975).

Relative differential cross sections for electrons inelastically scattered by Kr and Xe at impact energies between 100 and 3000 eV and at scattering angles between 5° and 55° are measured. The relative cross sections are put on an absolute scale by using the apparatus calibration factor derived from the authors' absolute measurement on N_2. An extensive comparison with experimental and theoretical data from literature is given. It was possible to derive apparent polarizabilities and total cross sections from the measured data. (auth)

23286 TOTAL CROSS SECTIONS FOR ELECTRON SCATTERING BY NOBLE GASES. Jansen, R. H. J.; de Heer, F. J. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 113-136 of Elastic Scattering of Electrons by Noble Gas Atoms and Nitrogen Molecules. Jansen, R. H. J. (ed.) Amsterdam; Amsterdam Univ. (7 May 1975).

Calculations are made of total cross sections for the scattering of electrons by noble gases by adding experimental total cross sections for ionization, excitation and elastic scattering and carried out for electron impact energies between 100 and 3000 eV. The accuracy of the total cross sections thus obtained is in the order of 10%. An extensive comparison with experimental, semi-empirical and theoretical data from literature is given. The use of total cross section in the application of dispersion relations is discussed. (auth)

23287 THEORETICAL CONSIDERATIONS. van Wingerden, B.; de Heer, F. J.; Jansen, R. H. J.; Los, J. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 114-157 of Elastic Scattering of Electrons by Noble Gas Atoms and Nitrogen Molecules. Jansen, R. H. J. (ed.). Amsterdam; Amsterdam Univ. (7 May 1975).

The difference in behavior of the differential elastic cross sections observed for He on the one hand, and noble gases on the other, is explained by applying classical and quantum mechanical criteria. Using a classical scaling law we have calculated the distances of closest approach for Ne, Ar, Kr and Xe. For high impact energies we have calculated the differential elastic cross sections for He in the Born and Born-exchange approximation. Comparison is made with the eikonal-Born series, the Rutherford formula and experiment. Finally, a survey of some recent theoretical models in the field of elastic electron-atom scattering is given. (auth)

23288 PREDICTIONS OF INNER-SHELL COULOMB IONIZATION BY HEAVY CHARGED PARTICLES. Hansteen, J. M.; Johnsen, O. M.; Kocbach, L. (Univ. of Bergen, Norway). At. Data Nucl. Data Tables.; 15: No. 4, 305-317(Apr 1975).

Probabilities for K-, L-, and M-shell ionization by impinging protons are presented as functions of the impact parameter. The results are based on the straight-line version of the semiclassical

approximation model. Values for total Coulomb ionization cross sections are given as well. A method for extension to other bare projectiles is indicated. (auth)

23289 ANGULAR DISTRIBUTION OF THE FRAGMENTS PRODUCED FROM COLLISIONALLY DISSOCIATED HeH^+ ION USING SLATER TYPE ORBITALS. Rai Dastidar, K.; Barua, A. K. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys.; 49: No. 1, 18-27(Jan 1975).

The angular distribution of the fragments produced from the electron impact dissociation of HeH^+ molecular ion has been studied in the energy range from 30 eV to 1000 eV by applying the Born approximation. For this purpose the electronic excitation, $X^1\Sigma \rightarrow A^1\Sigma$, coupled with rotational-vibrational transition has been considered. The electronic wave functions have been constructed from Slater type orbitals using two configurations for the $A^1\Sigma$ state and a single configuration for the $X^1\Sigma$ state of HeH^+ ion. It is found that there is no significant effect on the angular distribution of fragments due to the heteronuclearity of the molecular ion. (3 figs) (auth)

23290 DENSITY MATRIX EQUATION FOR ATOMIC SYSTEMS SUBJECT TO AN EXTERNAL RADIATION FIELD INTERACTION AND COLLISION PROCESSES. Kuehlke, D. (Univ., Jena, Ger.). Czech. J. Phys.; 25: No. 6, 644-659(1975).

Approximations are examined which are necessary for a density matrix equation of Rautian's form describing the interaction of a gas medium with an external radiation field by considering collision processes between active atoms as well as active and perturber atoms. The collision integrals of the kinetic density matrix equation calculated by the Bogolyubov method involve exitation processes, inelastic and elastic collisions. The features of phase- and velocity changing collisions are discussed by specializing the collision terms. Some phenomenological collision models for velocity-changing collisions are examined, and conditions for their validity given. (auth)

Atomic Theory

23291 (ANL-75-3-PI, pp 34) SYSTEMATICS OF MOMENTS OF DIPOLE OSCILLATOR-STRENGTH DISTRIBUTIONS: EXTENSION TO ATOMS OF THE THIRD ROW. Dehmer, J. L.; Hanson, J. D. 1974.

In Radiological and Environmental Research Division annual report: radiation physics, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

An ongoing program to study systematics in the Z dependence of moments of the dipole oscillator-strength distributions is extended to the atoms of the third row, K through Kr. The preliminary results for Kr are reported. (GHT)

23292 (CONF-7406109-(Absts.)) TWENTY-NINTH SYMPOSIUM ON MOLECULAR STRUCTURE AND SPECTROSCOPY, COLUMBUS, OHIO, JUNE 10–14, 1974. Abstracts. (Ohio State Univ., Columbus (USA)). 1974. 177p. Ohio State Univ., Columbus, OH.

A collection of the abstracts of papers presented at the symposium is given. Complete proceedings were not published. (RWR)

23293 (CONF-750665-(Absts.)) THIRTIETH SYMPOSIUM ON MOLECULAR STRUCTURE AND SPECTROSCOPY, COLUMBUS, OHIO, JUNE 16–20, 1975. Abstracts. (Ohio State Univ., Columbus (USA)). 1975. 188p. Ohio State Univ., Columbus, OH.

Abstracts for this conference are presented. Complete proceedings will not be published. (RWR)

23294 SPIN-FREE QUANTUM CHEMISTRY. XV. Spin-Only Neutron Diffraction. Matsen, F. A.; Picone, J. M.; Welsher, T. L. (Univ. of Texas, Austin). Int. J. Quant. Chem.; 9: No. 1, 157-169(Jan 1975).

The cross section for elastic neutron diffraction is analyzed for the spin-only case, in which the orbital contributions to the magnetic moment density are negligible. For systems specified by spin-free Hamiltonians, we show that the magnetic moment density is calculated from the unpaired electron density, a spin-free quantity, which is equivalent to the spin density. The computation of the unpaired electron density is outlined and examples are discussed. The scattering cross section for an infinite interaction range Heisenberg model exhibits a temperature dependence which parallels that of the spontaneous magnetization. With a knowledge of the unpaired electron density one may determine the magnetic space group symmetry. (auth)

23295 SPIN-FREE QUANTUM CHEMISTRY. XVI. Spin Correlation. Matsen, F. A.; Welsher, T. L. (Univ. of Texas, Austin). Int. J. Quant. Chem.; 9: No. 1, 171-188(Jan 1975).

The calculation of quasielastic critical neutron scattering for systems defined by a spin-free Hamiltonian is discussed. The system dependent property which determines the critical scattering is the thermal average of a spin-free operator called the general unpaired electron correlation operator. For localized models, the scattering is obtained as the Fourier transform of an unpaired site correlation function. The algebraic relationship between this correlation function and the usual spin correlation function is discussed as are its relationships to thermodynamic properties. Correlations in the infinite interaction range model, linear spin wave model, and infinite chain Heisenberg model are given. In the last case, an estimate of the low temperature correlation length is made. (auth)

23296 LINEAR PROBLEM OF THE RADIATION OF A MULTI-LEVEL ATOM. Nikogosyan, A. G. Astrophysics.; 9: No. 2, 125-133(1973).

Translated from Astrofizika; 9: No. 2, 221-235(1973).

The formation of multiplets in the spectra of atoms with a split upper energy level is considered. The problem is posed in the first part and solved in the case of the true redistribution law, the one-dimensional case being considered for simplicity. In the second section, a study is made of the three-dimensional problem of the formation of resonance lines in a semi-infinite isothermal atmosphere filled with atoms that have three energy levels whose schematic position corresponds to the case of the formation of the D lines of sodium and the H and K lines of ionized calcium. The intensities of the radiation leaving the medium in each of the lines is found in the case of complete frequency redistribution. These quantities are expressed in terms of Ambartsumyan's φ functions generalized to the matrix case. (auth)

23297 VARIATIONAL BOUNDS ON TRANSITION PROBABILITIES. Barnsley, M. F.; Robinson, P. D. (Bradford Univ., Eng.). Int. J. Quant. Chem.; 9: No. 3, 479-487(May 1975).

Complementary variational functionals are derived which impose upper and lower bounds on transition probabilities. These functionals are used to yield bounds in terms of sets of sum rules, and illustrative calculations are presented for hydrogen, helium and krypton atoms. 14 refs. (auth)

23298 REARRANGEMENT CORRECTION OF HIGHER POLARIZABILITIES OF TWO-ELECTRON SYSTEMS. Roy, H. P. (Univ. of Jadavpur, Calcutta); Bhattacharya, A. K. Int. J. Quant. Chem.; 9: No. 3, 495-504(May 1975).

The rearrangement correction is included in a coupled Hartree–Fock (CHF) calculation of atomic hyperpolarizabilities and other related properties. The effect of these corrections on properties like electric dipole hyperpolarizabilities, uniform electric field quadrupole polarizabilities and shielding factors in two-electron ions has been studied and significant changes in the computed values over the CHF results have been noticed. (13 refs) (auth)

23299 ALTERNATIVE PARAMETRIZATION FOR THE THEORY OF COMPLEX SPECTRA. Kibler, M. R. (Univ. de los Andes, Bogota, Colombia). Int. J. Quant. Chem.; 9: No. 3, 421-429(May 1975).

A new parametrization for the matrix, set up on the states of an open (nuclear or atomic) shell, of any two-body interaction expandable in multipoles is investigated. Such a parametrization is particularly convenient for expressing the term energies in a simple form and for producing high degeneracies among the terms. Further, the parametrization considered allows the two-body interaction to be decomposed into a Dirac interaction and a remaining part. (11 refs.) (auth)

23300 Z-DEPENDENT THEORY OF MANY ELECTRON ATOMS. I. Simplest S-Sums. Horak, Z. J. (Inst. of Solid State Physics, Prague). Czech. J. Phys.; 25: No. 7, 732-744 (1975).

Simplest possible S-sums $\langle p, \alpha \mid q, \beta \rangle_{kl}$ occurring in the second order Z-dependent theory of many-electron atoms are defined. $\langle , \alpha \mid l, \beta \rangle_{kl}$ are written in closed form for positive α, β and l integer ≥ 0; $\langle p, \alpha \mid q, \beta \rangle_{kl}$ for integer $p > l$, $q > l$ can be reached by means of recurrence relations. The new method is demonstrated and tested on examples previously calculated in the literature. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstracts 23314 and 23316.

23301 (N-73-18726) LINEARIZED THEORY FOR MPD DUCT FLOWS WITH EXTERNAL MAGNETIC FIELDS AND HALL EFFECT. Technical Report, 1 January–31 December 1972. Robert, K. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Porz-Wahn (F. R. Germany). Inst. fuer Angewandte Gasdynamik). 1972. 53p. (DLR-FB-72-67). NTIS $4.75.

An examination is made of the steady, inviscid, and barotropic flow of a rarefied gas plasma through a cylindrical duct of finite length and nonconducting wall, under the influence of an imposed axially directed electric field and an axisymmetric external magnetic field, taking the Hall effect into account. Using continuum methods the problem is solved three-dimensionally, assuming both the magnetic Reynolds number and the Hall parameter are much smaller than one. By means of a perturbation method, closed form solutions for the electric current density, flow velocity, and mass density are derived in the case of weakly curved magnetic lines of force. (auth)

23302 (N-73-31839) ELECTROHYDRODYNAMIC HEAT PIPE RESEARCH. Final Report. Jones, T. B.; Perry, M. P. (Colorado State Univ., Fort Collins (USA). Dept. of Electrical Engineering). Jul 1973. Contract NGR-06-002-127. 49p. (NASA-CR-114646). NTIS $4.50.

Experimental and theoretical applications to electrohydrodynamic heat pipe (EHDHP) research are presented. Two problems in the research which are discussed are the prediction of the effective thermal conductance of an EHDHP with threaded grooves for fluid distribution to the evaporator of an EHDHP. Hydrodynamic equations are included along with a discussion of boundary conditions and burn-out conditions. A discussion of the theoretical and experimental results is presented. (GRA)

23303 MOVEMENT OF A FERROSUSPENSION IN ROTATING MAGNETIC FIELDS. Glazov, O. A. Magn. Gidrodin.; No. 2, 16-22(1975). (In Russian).

The possibility of increasing the rotation rate of a ferrosuspension by a magnetic field moving in the azimuthal direction was studied. For a description of the suspension, a hydrodynamic model was used which included the rotation of the suspended particles. The azimuthal velocity profile was determined for the limiting cases of weak and strong magnetic fields. In weak magnetic fields, the azimuthal velocity is significantly less than the phase velocity of the traveling magnetic field. In strong fields, the limiting value of the velocity does not depend on the magnetic field. For a sufficiently large volume concentration and number of harmonics of the traveling field, the velocity becomes comparable with the phase velocity of the traveling magnetic field. The rotation of the polarized fluid due to the homogeneous magnetic field is explained by the existence of higher spatial harmonics. For the rotation of a ferrosuspension, it is recommended that a magnetic field with a number of base harmonics larger than unity be used. The motion would then be determined by the base harmonics, but not by the higher harmonics, and therefore a sufficiently high rotation rate could be attained. (tr-auth)

23304 UNSTEADY SMALL PERTURBATIONS IN PLANE FLOWS OF A CONDUCTING PLASMA IN A CHANNEL. Shubin, A. P. Zh. Prikl. Mekh. Tekh. Fiz.; No. 1, 19-29(1975). (In Russian).

By a linear approximation, consideration is given to nonsteady magneto-hydrodynamic perturbations of plane waves of a conducting, nonviscous, and non-heat-conducting quasi-neutral plasma in a channel having a slowly varying cross section with segmented electrodes. The Hall effect is taken into account in this treatment. It is shown that the evolution of an isomagnetic perturbation parameter B/ρ consists of a transfer along the channel jointly with the plasma flow, a transfer along the unperturbed electron trajectories, and diffusion because of the finite conductivity of the plasma. Time of establishing the flow is equal to the time of flight of the plasma through the channel (region occupied by the magnetic field). This study is a generalization of a previous study analyzing steady perturbations. (SJR)

23305 APPLICATION OF THE SPLITTING METHOD TO A CALCULATION OF TWO-DIMENSIONAL MAGNETOGASODYNAMIC FLOW. Bakhrakh, S. M.; Gubkov, E. V. Magn. Gidrodin.; No. 2, 9-15(1975). (In Russian).

The finite difference method was discussed for the calculation of two-dimensional axially symmetric flow of compressed media with finite conductivity in an azimuthal magnetic field. The use of the splitting method according to the physical processes appears to be a characteristic of the computational methodics. The results of the numerical resolution of the problem on the compression of axially symmetric body by a magnetic field created by currents flowing in the skin layer along the sample were reported. (tr-auth)

23306 NATURAL CONVECTION IN THE CASE OF A POWER LAW DISTRIBUTION OF PLATE TEMPERATURES AND STRONG MAGNETIC FIELD. Sapunkov, Ya. G. Magn. Gidrodin.; No. 2, 23-28(1975). (In Russian).

The method of internal and external expansion was used to solve a problem on the natural convection of a viscous heat-conducting and electroconducting fluid at small magnetic Reynolds numbers. The first three approximations were constructed for both the external and the internal regions. In the internal region, precise analytical solutions were obtained, while in the external regions, the same problem was solved numerically. (tr-auth)

23307 MHD FLOW IN ROUGH TUBES. Tananaev, A. V. Magn. Gidrodin.; No. 2, 29-34(1975). (In Russian).

Laminar and turbulent MHD flows in rough channels were examined. It was shown that the roughness elements form a shunting region through which the induced currents are short circuited. This explains, in particular, the much steeper increase of the resistance to movement than found in smooth channels and the abnormal distribution of the averaged flow rate. Known experimental data are discussed, and new results of the measurement of the coefficient of resistance and the velocity profile are reported, both of which support the theoretical results. (tr-auth)

23308 BREAKUP OF A MAGNETIC LIQUID JET. Taktarov, N. G. Magn. Gidrodin.; No. 2, 35-38(1975). (In Russian).

The stability and breakup into individual drops of jets of magnetic liquids moving in a solenoid field were studied in the linear approximation. The presence of a magnetic field increases the dimensions of the drops formed. The length of the unbroken part of the jet is increased with increasing magnetic field. (tr-auth)

23309 CALCULATION OF A MODEL FOR AN MHD EXPERIMENT ON STRESS RELAXATION IN TURBULENT MEDIA. Pleshanov, A. S.; Tsinober, A. B.; Chusov, M. A. Magn. Gidrodin.; No. 2, 39-44(1975). (In Russian).

An experimental plan is proposed for the study of turbulent Maxwell fluids in which relaxation of the turbulent stress occurs, including the behavior of the system under the effects of a given external perturbation. Calculations of the model were made for constant coefficients of the viscosity and relaxation time, and the results indicate that the relaxation effect is detectable. The basic parameters of the experimental installation were also calculated. (tr-auth)

23310 APPROXIMATE CALCULATION OF THE VELOCITY FIELD IN CYLINDRICAL AND FLAT MHD CHANNELS. Siplivyi, B. N. Magn. Gidrodin.; No. 2, 45-53(1975). (In Russian).

Velocity fields in cylindrical and flat MHD channels were calculated using approximate flow equations obtained by evaluating terms in the Navier-Stokes equation. For the non-inductive approximation, the problem required a solution of the integral second-order Fredholm equation. The velocity distribution in a flat MHD channel in a transverse non-uniform magnetic field was calculated as an example. (tr-auth)

23311 THREE-DIMENSIONAL VISCOUS CONDUCTING FLUIDS IN COAXIAL MHD CHANNELS WITH ASYMMETRIC FIELD. Kivalev, L. K.; Koneev, S.M.A.; Nikitin, Yu. M. Magn. Gidrodin.; No. 2, 54-60(1975). (In Russian).

Results are reported for a theoretical study of the three-dimensional laminar expanded MHD flow of a conducting fluid in a coaxial MHD conducting channel with radii $r_1(\epsilon z)$ and $r_2(\epsilon z)$. The external asymmetric field is created by longitudinal current I, separated from the geometric axis of the channel by the value $1 = \delta r_0$ (r_0 is the radius of the internal electrode at the input). ϵ and δ characterize the asymmetry of the meridian curvature of the circular electrodes and the asymmetry of the external magnetic field, respectively. Under the assumption that the parameters ϵ and δ are small ($\epsilon \ll 1, \delta \ll 1$, and $\epsilon \sim \delta$), the three-dimensional problem is reduced to the corresponding two-dimensional problem. Analytical solutions, obtained in the zero and first order of ϵ and δ, are given for the three-dimensional distribution of the velocity and potential. (tr-auth)

23312 STRUCTURE OF CURRENTS IN THE END REGIONS OF MHD CHANNELS WITH CONTINUOUS ELECTRODES. Gorodzha, L. V.; Rashchenkin, A. P. Magn. Gidrodin.; No. 2, 61-67(1975). (In Russian).

The electrical processes in the flow of an anisotropically conducting plasma were studied under the assumption of an uneven variation of the magnetic field in the end regions of the electrodes. The solution of the electromagnetic equations was accomplished using the method of the Riemann boundary problem for automorphic functions. The final result was given in the form of an integral Fredholm equation which, with a Hall parameter equal to unity, has a precise solution. For this case, the distribution of the current density on the electrodes was calculated, and an evaluation was made of the energy characteristics of the channel. (tr-auth)

23313 MEASUREMENT OF THE FLOW RATE OF CONDUCTING FLUIDS BY MEANS OF AN ORIFICE IN THE MAGNETIC FIELD. Butsenieks, I. E.; Shcherbinin, E. V. Magn. Gidrodin.; No. 2, 131-135(1975). (In Russian).

Experimental data are reported on the dependence of the pressure drop at an orifice on the imposed transverse magnetic field. For circular orifices, the dependence of the pressure drop on the sampling site was obtained for different relative cross sections. The possibility of measuring the flow rate by means of an orifice in the magnetic field was examined. (tr-auth)

23314 MASS TRANSFER FROM THE SURFACE OF THE CYLINDER IN ELECTROMAGNETIC FIELDS. Oreper, G. M. Magn. Gidrodin.; No. 2, 138-139(1975). (In Russian).

The process of mass transfer from the dissolved part of the surface of infinite cylinders was examined for electroconducting fluids in electromagnetic fields. The equation determining the effect of the electromagnetic force on the dimensionless mass transfer coefficient was found. (tr-auth)

23315 NON-SELF-SIMILAR JETS IN SATELLITE FLOW IN A STRONG LONGITUDINAL MAGNETIC FIELD. Derendyaev, N. V. Magn. Gidrodin.; No. 2, 140-142(1975). (In Russian).

A non-self-similarity solution was obtained in the MHD boundary layer approximation for weak axially symmetric jets of viscous incompressible fluids in satellite flow at small magnetic Reynolds numbers. It was shown that at large distances from the source, the solution obtained for axial symmetry approaches self-similarity. The effect of the satellite flow on the jet field was studied. (tr-auth)

23316 EXPERIMENTAL STUDY OF THE CIRCULATION OF A LIQUID METAL IN AN ELECTROMAGNETIC FIELD. Getselev, Z. N.; Kreindel, D. A.; Kaptilkin, A. A.; Martynov, G.I. Magn. Gidrodin.; No. 2, 144-146(1975). (In Russian).

A study was made of the circulation of a liquid metal under the effects of an unbalanced electromagnetic force. A cylindrical vessel with a diameter of 350 mm and filled with Sn at 250°C was used, and the electromagnetic field was excited by a circular inductor variable along the vertical axis. The original construction of the installation for simultaneous measurement of three spatial components of the dynamic pressure is described. The vertical and radial components of velocity and magnetic induction were measured, and the changes in the flow structure and in the induction zone dimensions of the melt are analyzed at frequencies from 50 to 2500 Hz. A diagram of the distribution of the flow function, the modulus of the velocity vector, and the magnetic field intensity vector are given for the most interesting trend occurring through the center of circulation of the melt. The effect of shielding the field was established. (tr-auth)

23317 A NOTE ON PHYSICAL REQUIREMENTS FOR THE EXISTENCE OF CERTAIN NON-UNIFORM SHOCK WAVES IN MAGNETO-GAS DYNAMICS. Rogers, C. (University of Western Ontario, London (Canada)); Castell, S. P. (Bearing Research Centre, Ransome Hoffmann Pollard Ltd., Essex, England). Acta Mech.; 19: No. 1-2, 23-32(1974).

Certain shock phenomena in non-steady oblique-field magnetogasdynamics are discussed. In particular, it is shown how necessary physical restrictions (i.e., density and pressure must be positive and finite) may be fulfilled by appropriate specialization of available parameters. (auth)

23318 STUDY OF THE SLOWING DOWN OF A SUPERSONIC, PLASMA FLOW IN A MAGNETIC FIELD. Baranov, V. Yu.; Vedenov, A. A.; Malyuta, D. D.; Mezhevov, V. S. (Inst. of Atomic Energy, Moscow). Dokl. Akad. Nauk SSSR; 219: No. 6, 1338-1340 (21 Dec 1974). (In Russian).

An investigation is made of the details in the slowdown of a supersonic plasma stream in a MHD-channel in the presence of a Hall effect. The channel dimensions were: L = 17 cm; inlet cross-section 2×5.5 cm^2; exit cross-section = 2×6.5 cm^2; sectioned electrodes (n = 5). Inert argon gas with cesium additive was heated by an electric arc to a slowing-down temperature of 3000 to 7000°K. The Mach number at the channel inlet was $M_0 \sim 1.7$ and the magnetic field = 0.5 to 5 tl. Measurements were made on the Hall and Faraday electric fields and current densities, the temperature and concentration of electrons, flow rate, Mach number and static pressure. The change in Mach number ΔM is small at the beginning of the channel. With increasing distance from the inlet a larger fraction of the kinetic energy of the stream is dissipated in slanting density discontinuities with a change in ΔM of ~ 0.025 at each discontinuity. Thus a substantial part of the energy flow can be dissipated in discontinuities arising at current concentration points. (SJR)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

23319 (COO-1428-421) ANNUAL PROGRESS REPORT, JUNE 1, 1974–MAY 31, 1975. (Purdue Univ., Lafayette, Ind. (USA)). 1975. Contract AT(11-1)-1428. 55p. Dep. NTIS $5.75.

Experimental high energy physics research is summarized. A list of publications is included. One section of the report is abstracted separately in NSA. (JFP)

For an abstract of an individual section see: 23333.

Electromagnetic

23320 (COO-3069-327) HADRON AND PHOTON PRODUCTION OF J PARTICLES AND THE ORIGIN OF J PARTICLES. Ting, S. C. C. (Massachusetts Inst. of Tech., Cambridge (USA)). 1975. 47p. (CONF-750654-1; OSP-73622). Dep. NTIS $5.50.

From international conference on high energy physics; Palermo, Italy (Jun 1975).

Discovery of the J particles (psi-3105 and psi-3695) is detailed. A few experiments on the production of J particles are described, emphasizing photoproduction of J's by photons and hadrons. Finally, current theoretical attempts at explaining their origin are outlined. (29 figures) (SDF)

23321 (DESY-75/05) PHOTOPRODUCTION OF Φ-MESONS AT SMALL t-VALUES. Fries, D. C.; Heine, P.; Hirschmann, H.; McNeely, W. A. Jr.; Markou, A.; Seitz, E.; Behrend, H. J.; Bodenkamp, J.; Hesse, W. P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Mar 1975. 5p. INIS.

2 figs.; 2 tabs.; 13 refs. To be published in Phys. Lett.

The reaction $\gamma + p \rightarrow \Phi + p$ has been measured using a spark chamber spectrometer and a tagged photon beam in the energy range from 4.6 to 6.7 GeV. Approximately 3,500 photoproduced elastic Φ-events have been collected in the t range between t,min and $t = -0.4$ (GeV/c)^2. Cross sections and t distributions are presented. (auth)

23322 PROCESSES $\mu \rightarrow 3\mu$, $\gamma \rightarrow 2\mu$ AND MEASUREMENT OF THE PSI MESON STRONG INTERACTION CROSS SECTION. Gershtein, S. S.; Pirogov, Yu. F.; Folomeshkin, V. N. (Inst. of Physics of High Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1326-1330(Jun 1975). (In Russian).

The possibility to study the ψ meson properties in high energy γ-quanta and muonic beams is discussed. The cross sections of the processes $\gamma p \rightarrow \psi p$ and $\mu p \rightarrow \mu \psi p$ must be respectively, about 5 nb and $5 \cdot 10^{-3}$ nb. If the experimental $\mu\bar{\mu}$ mass resolution is about 0.1 GeV, then the cross section of muonic pair production via the ψ meson decays can several times exceed the cross section of the electromagnetic production of muonic pairs. (auth)

Weak

23323 (JINR-P1-8875) SEARCH FOR $\mu^+ \rightarrow e^+ + e^+ + e^-$ DECAY. Korenchenko, S. M.; Kostin, B. F.; Mitsel'makher, G. V.; Nekrasov, K. G.; Smirnov, V. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The search for the $\mu^+ \rightarrow e^+ + e^+ + e^-$ decay was carried out with the help of a magnetic spark spectrometer. It is found that $W(\mu^+ \rightarrow e^+ + e^+ + e^-)/W(\mu^+ \rightarrow e^+ + \nu_e + \bar{\nu}_\mu) \leq 1.9 \cdot 10^{-9}$ with 90% confidence level. (1 figure) (auth)

23324 DETERMINATION OF $\chi_1\eta_{+0}$ AND η_{000} FROM BUBBLE CHAMBER MEASUREMENTS. Votruba, J. (Inst. of Physics, Prague). Czech. J. Phys.; B25: No. 6, 619-625(1975).

Formulas for time distribution of neutral kaon decay in material medium are derived and discussed. Essential effects of the medium are emphasized which should be taken into account in the discussion of the bubble chamber experiments in which the $\Delta S = \Delta Q$ rule and CP-violation are studied. (auth)

Strong (Baryon-induced)

Refer also to abstract 23392.

23325 (ANL/HEP-CP-75-15) CONCLUSIONS FOR THE Xth MORIOND CONFERENCE ON THE PHENOMENOLOGY OF HADRONIC STRUCTURE. Yokosawa, A. (Argonne National Lab., Ill. (USA)). [nd]. 19p. (CONF-750309-5). Dep. NTIS $4.00.

From 10th moriond meeting; Meribel-Les-Allues, France (2 Mar 1975).

A summary is presented of the talks presented on the phenomenology of hadronic structure including diffractive, elastic, and diffractive–dissociation data, correlation experiments, multiplicity at large transverse momentum, high and low energy phenomenology, results from the proton synchrotron, psi production, and the np charge-exchange reaction. (JFP)

23326 (ANL/HEP-CP-75-31) MULTIPARTICLE PROCESSES: RECENT RESULTS FROM THE FNAL 30-INCH BUBBLE CHAMBER. Musgrave, B. (Argonne National Lab., Ill. (USA)). 1975. 87p. (CONF-750659-1). Dep. NTIS $7.50.

From fourth international seminar on high energy physics problems, many-body processes; Dubna, USSR (Jun 1975).

Some recent results on inclusive resonance production, on multiplicity distributions and on diffractive processes from the 30-inch bubble chamber at FNAL are reviewed. (45 figures, 52 references) (auth)

23327 (COO-3065-119) STUDIES OF NEUTRON DISSOCIATION AT FERMILAB ENERGIES. Ferbel, T. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 20 Jun 1975. E(11-1)-3065. 34p. (CONF-750654-9). Dep. NTIS $4.75.

From international conference on high energy physics; Palermo, Italy (Jun 1975).

The latest results obtained in a continuing investigation of neutron dissociation in (p π^-) systems in neutron–nucleus collisions between 50 and 300 GeV/c are summarized. The nuclear coherent dissociation data are discussed first; then new measurements of total cross sections of neutrons on nuclei in the Fermilab momentum range are presented; finally, neutron dissociation using a hydrogen target is considered, and the hydrogen data are compared with expectations from simple Deck models. A substantial correlation was observed between the mass and the t of the system produced. The spin structure of the p π^- amplitudes at low mass was described surprisingly well by the simple Deck mechanism. The t-channel helicity amplitudes contained comparable contributions from flip and nonflip terms, and the states produced were not restricted to those expected on the basis of the Morrison rule. (19 figures, 2 tables) (RWR)

23328 (LA-UR-75-1244) PION PRODUCTION IN NUCLEON–NUCLEON COLLISIONS. Stephenson, G. J. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-ENG-36. 7p. (CONF-750631-5). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

The summary of research on pion production in nucleon–nucleon collisions is presented giving an idea of the quality of the data now becoming available. Attention is called to some regularities. (JFP)

23329 (LA-UR-75-1284) SOME TOPICS CONCERNING N–N AND N–D EXPERIMENTS AT MEDIUM ENERGY. Simmons, J. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. 24p. (CONF-750631-4). Dep. NTIS $4.25.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

The status of recent proton-proton phase shift analyses is reviewed at medium energy with mention of the state of the n-p I equals 0 analyses. Some conclusions are reached, including a recommendation for renewed theoretical effort to calculate absorption parameters for N–N scattering above 300 MeV in higher partial waves (l greater than or equal to 3). Recent experimental data are examined for p-p small angle scattering at 630 MeV and also near 500 MeV. Further small angle experiments on p-p and p-d scattering are deemed desirable. A brief discussion of recent n-p charge exchange experiments is given. Finally, the status of medium to high energy (100 to 2000 MeV) p-d elastic scattering is reviewed with emphasis on back angle scattering and the usefulness of p-d polarization measurements. (1 table, 12 figures, 94 references) (auth)

23330 EFFECTIVE MECHANISM OF PRODUCTION OF CHARMED PARTICLES IN NEUTRINO AND ANTINEUTRINO BEAMS. Arbuzov, B. A.; Gershtein, S. S.; Folomershkin, V. N. (Inst. of Physics of High Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1322-1325(Jun 1975). (In Russian).

The following effective mechanism of production of charmed particles in neutrino and antineutrino beams is presented: the charmed virtual vector F^* meson is produced in the weak $\nu F^* \mu$ vertex (the Cabibbo angle suppression is absent) and thereafter strongly rescatters by a nucleon. This diffraction mechanism must give a main contribution to the production cross section of charmed particles in the neutrino experiment at the energies up to several hundred GeV. Charmed particles are predominantly

produced at limited momentum transfers and show equal cross sections in neutrino and antineutrino beams. (auth)

23331 DIFFRACTIVE GENERATION OF PARTICLES IN COHERENT INTERACTIONS OF PROTONS WITH EMULSION NUCLEI IN THE ENERGY RANGE 20 TO 70 GeV. Azimov, S. A.; Gulamov, K. G.; Gulyamov, U. G.; Navotnyi V. Sh.; Svechnikova, L. N.; Chernova, L. P.; Chernov, G. M. (Physical-Technical Inst., Tashkent). Yadern. Fiz.; 21: No. 6, 1247-1256(Jun 1975). (In Russian).

The cross section of the (p → n prongs) channels (n = 1, 3, 5), of $p \rightarrow p\pi^+\pi^-$ and $p \rightarrow p2\pi^+2\pi^-$ coherent dissociation of 21, 50 and 60 GeV/c protons on emulsion nuclei are measured. The energy dependence of the main dynamical characteristics of the reaction $pA \rightarrow p\pi^+\pi^-A$ is studied. An attempt is made to explain the features of the latter reaction in the framework of the OPE model and in the double Regge model. The decay angular distributions do not contradict the t- and s-channel chirality conservation. (8 figures, 2 tables) (auth)

23332 MULTIPLICITY DISTRIBUTIONS OF π^0, K^0 MESONS AND Λ^0 HYPERONS PRODUCED IN π^-p INTERACTIONS AT 40 GeV/c MOMENTUM. Amaglobeli, N. S.; Grishin, V. G.; Dzhmukhadze, S. V.; Ikov, N.; Kladnitskaya, E. N.; Popova, V. M.; Sabeu, M.; Tevzadze, Yu. V.; Tsivtsivadze, E. T.; Chargeishvili, M. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1227-1232(Jun 1975). (In Russian).

The available multiplicity of secondary particles (π^+, π^-, π^0, K^0, Λ^0) is analysed in a wide energy range from 40 to 300 GeV for π^-p and pp collisions. The experimental results give an evidence for the multiplicity scaling in the energy range under consideration. The form of the function Psi does not depend upon the kind of primary particles (p, π, anti p). (3 tables, 4 figures) (auth)

Strong (Meson-induced)

23333 (COO-1428-421, pp 20-32) COUNTER-WIRE CHAMBER EXPERIMENTS AT ANL. Garfinkel, A. F.; Loeffler, F. J.; Shibata, E. I.; Stanfield, K. C. 1975.

In annual progress report, June 1, 1974--May 31, 1975. (Purdue Univ., Lafayette, Ind, (USA)).

23334 (JINR-P1-8793) FOUR-PRONG π^-p INTERACTIONS WITH π^0 PRODUCTION AT 5 GeV/c. II. Cross Section Determination by the Statistical Method; Study of the Characteristics of Processes with Proton and Neutron Production. Amaglobeli, N. S.; Budagov, Yu. A.; Vinogradov, V. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The results of the experimental investigation of $\pi^-p \rightarrow p\pi^+\pi^-\pi^- + m\pi^0$ and $\pi^-p \rightarrow n\pi^+\pi^+\pi^-\pi^- + m\pi^0$ ($m \geq 1$) processes at 5 GeV/c are reported. The partial cross sections for the mentioned processes were determined by the statistical method, the resonance production was studied, and the angular and momentum distributions of charged secondaries were analyzed. The results are compared with the available data at other energies and with the predictions of theoretical models. (5 figures, 3 tables) (auth)

23335 (JINR-P1-8845) SOME CHARACTERISTICS OF SEMI-INCLUSIVE REACTIONS $\pi^-p \rightarrow \gamma + n_s + \ldots$ AT 40 GEV/C. Angelov, N. S.; Kerachev, P. P.; Semerdzhiev, Kh. I.; Tsivtsivadze, E. T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Some semi-inclusive momentum and angular distributions of γ-quanta in the c.m.s. are given which were obtained from the studies of 5148 π^-p interactions at 40 GeV/c. Experimental data are compared with the calculations over the phase volume according to the multiperipheral model. (4 figures, 5 tables) (auth)

23336 (KFK-EXT-3/75-1) MEASUREMENT OF $\pi\pi$-SCATTERING IN THE REACTION $\pi^-p \rightarrow \pi^0\pi^0n$ AT 6, 8 AND 12 GeV/c. Apel, W. D.; Auslaender, J. S.; Mueller, H.; Rehak, P. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Jun 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

Data in the $\pi\pi$-mass region 0.6 to 1.6 GeV/c^2 are analyzed. $\pi^0\pi^0$-mass spectra and angular distributions near 1.0 GeV/c^2 reflect the strong coupling of the $K\bar{K}$-system near threshold to $\pi\pi$. Below the f^0-meson a large s-wave contribution is observed. $\pi^0\pi^0$-data are compared with the ambiguous phase shift solution of the CERN-Munich group. (8 figures) (auth)

23337 (ORO-2504-236) REMARKS ON THE STATUS OF THE Z_1*. Steinberg, P. H. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jul 1975. 11p. Dep. NTIS $4.00.

Two developments which provide evidence for the existence of the Z_1* resonance are discussed. The first involves improved results for K^+p elastic scattering differential cross sections. The second is an energy dependent partial wave analysis based on k matrix formalism. Other supporting evidence is briefly considered. (3 figures) (SDF)

23338 STUDY OF π^- MESON ELASTIC SCATTERING BY PROTONS AT SMALL ANGLES. Apokin, V. D.; Derevshchikov, A. A.; Matulenko, Yu. A. (Inst. of Physics of High Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1240-1246(Jun 1975). (In Russian).

The π^--meson elastic scattering by protons is measured at 40 and 50 GeV/c by using the Serpukhov accelerator. The analysis of the data in the region of the Coulomb interference yields the following values of the ratio of the real part of the strong interaction amplitude to its imaginary part: $\rho(0) = -0.074 \pm 0.033$ at 40 GeV/c and $\rho(0) = -0.007 \pm 0.026$ at 50 GeV/c. (3 tables, 2 figures) (auth)

23339 CROSS SECTIONS FOR PRODUCTION OF STRANGE PARTICLES IN π^-p INTERACTIONS AT 4.9 GeV/c. Glagolev, V. V.; Dushutin, N. K.; Kladnitskaya, E. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1233-1239(Jun 1975). (In Russian).

Cross sections for production of strange particles at the momentum $p_{\pi^-} = 4.9$ GeV/c are determined by means of the 100-cm hydrogen bubble chamber at JINR. The obtained cross sections are compared with the data at other energies and are used to analyse the mechanism of the strange particle production by means of a test of the sum rules for the cross sections. (5 tables, 5 figures) (auth)

23340 S MATRIX APPROACH TO MULTIPLE GENERATION OF HADRONS. Dushutin, N. K.; Mal'tsev, V. M.; Sinegodskii, S. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1294-1297(Jun 1975). (In Russian).

Recurrent relations for many-particle amplitudes are considered in the S matrix approach to multiple generation of hadrons. The one and two-particle generation is discussed in detail. It is shown that in the latter case the second correlation parameter can be negative independent of the kinematics. (auth)

23341 MULTIPLICITY OF SECONDARY PARTICLES IN π^-p INTERACTION AT 40 GeV/c. Angelov, N.; Grishin, V. G.; Kerachev, P. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1298-1302(Jun 1975). (In Russian).

Multiplicity distributions of π^0 mesons and of all secondary particles produced in π^-p interactions at 40 GeV/c are obtained. The results are compared with the phenomenological model. (2 figures, 2 tables) (auth)

Particle Interactions and Properties (Theoretical)

23342 (JINR-P2-8854) PSI-MESON INTERPRETATION WITHIN THE THREE-TRIPLET MODEL WITH INTEGER QUARK CHARGES. Govorkov, A. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 40p. Dep. NTIS (US Sales Only) $5.00.

Recently discovered narrow meson resonances psi-3105 and psi-3695 are interpreted as new $\tilde{\omega}$- and phi-mesons predicted by three-triplet model with integer quark charges. The consequences of such an identification are discussed. (43 references) (auth)

General

Refer also to abstract 23320.

23343 (RL-75-094) ONE-DIMENSIONAL APPROXIMATION FOR THE POMERON IN THE DUAL UNITARITY SCHEME. Sakai, N. (Science Research Council, Chilton (UK). Rutherford Lab.). Jun 1975. 40p. Dep. NTIS (US Sales Only) $5.00.

Using a one-dimensional approximation, the Pomeron in the dual unitarity scheme is examined analytically in a multiperipheral cluster model. Clusters have negative short range correlation due to the t_{min} effect. In dual models, the Pomeron has crossing odd part, especially in BB and $B\bar{B}$ scattering. By taking all Reggeon loops into account, it is shown explicitly in this approximation that the crossing odd part has only lower lying singularities in j-plane (typically complex poles with Re $\alpha \simeq 0.2$) whereas the crossing even part has the leading singularity at $j = \alpha_p = 1$. The dual unitarity scheme leads to a modified version of the f-dominance of the Pomeron. The SU(3) breaking of the Pomeron due to the SU(3) breaking among Regge trajectories is calculated without additional assumptions on the SU(3) property of the Pomeron. (auth)

23344 PROPERTIES OF QUASIELASTIC PROCESSES DUE TO EXCHANGE OF ONE DUAL POMERON. Gedalin, E. V.; Gurvich, E. G. (Inst. of Physics, Tbilisi, USSR). Yadern. Fiz.; 21: No. 6, 1303-1315(Jun 1975). (In Russian).

Asymptotical (at $s \to \infty$) properties of the four-particle amplitudes of diffractional scattering of resonance states in DRM are considered in the lower order of the dual perturbation theory. It is shown that at the transversal momentum transfer $\chi \to 0$, the scattering amplitudes vanish for at least a part of the state spectrum in DRM, for the transversal states, except the case of the elastic scattering amplitudes that are all identical. (auth)

Electromagnetic

Refer also to abstracts 23073 and 23536.

23345 (N-74-21440, pp 198-206) GYROSYNCHROTRON RADIATION FORMULAE. Ko, H. C. (Ohio State Univ., Columbus). 1972.

From proceedings on high energy phenomena on the sun; Greenbelt, Maryland, USA (28 Sep 1972).

In high energy phenomena on the sun. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center).

The wave-normal emissivity and the ray emissivity formulas for an electron moving along a helical path in a magnetoactive medium are presented. Simplified formulas for the case of an isotropic plasma are also given. Because of the helical motion of the electron, one must distinguish between the radiated power per unit solid angle and the received power per unit solid angle. The relation between these two quantities in a magnetoactive medium is shown. Results are compared with those obtained by others, and the sources of discrepancies are pointed out. (auth)

23346 SUM RULES FOR SCATTERING OF ISOVECTOR PHOTONS. Novikov, V. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 21: No. 6, 1265-1270 (Jun 1975). (In Russian).

New sum rules relating the electromagnetic characteristics of nucleons to the scattering cross sections of the isovector photons are obtained. (auth)

23347 SCATTERING OF LEPTONS ON A POLARIZED PROTON TARGET AND NEUTRAL CURRENTS. Bilen'kii, S. M.; Dadayan, N. A.; Khristova, E. Kh. (Joint Inst. of Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 6, 1271-1277 (Jun 1975). (In Russian).

The P-odd asymmetry arising in the scattering of nonpolarized leptons (antileptons) on a polarized proton target is calculated in the Weinberg model. The elastic and deep inelastic lepton-proton scatterings are considered. The longitudinal asymmetry is calculated in a wide angular and energy range at various values of Weinberg's parameter $\sin^2(\theta_W)$. (1 table, 4 figures) (auth)

Weak

23348 (CONF-750307-9) INVESTIGATIONS OF THE STRUCTURE OF THE NEUTRAL CURRENT COUPLING IN INCLUSIVE NEUTRINO INTERACTIONS. Barish, B. C.; Bartlett, J. F.; Bodek, A. (California Inst. of Tech., Pasadena (USA); Fermi National Accelerator Lab., Batavia, Ill. (USA)). 9 Apr 1975. Contract AT(11-1)-68. 14p. Dep. NTIS $4.00.

From international colloquium of the CNRS on neutrino physics at high energy; Paris, France (18 Mar 1975).

Preliminary results from a neutral current experiment performed in the Fermilab narrow band neutrino beam are presented. The hadron energy distributions obtained from high energy neutral current interactions in both neutrino and antineutrino beams are presented, and are used to infer constraints on the possible kinds of neutral current coupling. Strongly dominant scalar and pseudoscalar couplings are not consistent with the distributions observed, nor is a dominant V + A coupling. Very preliminary studies show no inconsistency with some combination of V + A and V - A couplings. (auth)

23349 RESTRICTIONS ON THE SECOND-KIND CURRENTS FROM DEEP-INELASTIC νN SCATTERING. Shmatikov, M. Zh. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1278-1280(Jun 1975). (In Russian).

Restriction on the magnitude of the second-kind currents is obtained from the data on neutrino-nucleon scattering at high energies. (auth)

Strong (General)

Refer also to abstract 23325.

23350 (JINR-P2-8760) PROPERTIES OF "LEADING" HADRONS PRODUCED IN MULTIPLE PRODUCTION PROCESSES. Kalinkin, B. N.; Lyubimov, V. B.; Tuvdendorzh, D.; Cherbu, A. V.; Shmonin, V. L. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The interaction of a hard part of the spectrum of hadrons, produced in multiple processes, with nucleons in nuclei has been investigated. It is found out that this interaction is anomalously small, the estimates of its value have been obtained. The results confirm the necessity of a space-time description of the processes using the composite hadron models. (7 figures) (auth)

23351 (KFKI-75-30) EXTENDED PARTICLE MODEL WITH QUARK CONFINEMENT AND CHARMONIUM SPECTROSCOPY. Hasenfratz, P.; Kuti, J.; Szalay, A. S. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 27p. (CONF-750309-6). Dep. NTIS (US Sales Only) $4.00.

From 10th moriond meeting; Meribel-les-Allues, France (2 Mar 1975).

An extended particle model with quark confinement is proposed here. The model is treated in the Born–Oppenheimer approximation, and an approximate charmonium spectrum is calculated. Several theoretical problems are discussed, and further work in progress is briefly summarized. (4 figures) (auth)

23352 (RL-75-084) BUILDING A GENERAL FRAMEWORK FOR HADRON COLLISIONS. Aurenche, P.; Ng Sing Wai; Paton, J. E.; Tsou Sheung Tsun.; Chan Hong-Mo; Gula, A.; Inami, T.; Roberts, R. G. (Oxford Univ. (UK). Dept. of Theoretical Physics; Science Research Council, Chilton (UK). Rutherford Lab.). May 1975. 47p. Dep. NTIS (US Sales Only) $5.50.

An attempt is made to construct a general framework for hadron collisions based on unitarity and duality. (JFP)

Strong (Baryon No. = 0)

23353 CONSEQUENCES OF DIRECT PSI–LEPTON COUPLING. Frampton, P. H.; Rabi, V. (Syracuse Univ., NY). Lett. Nuovo Cim.; 13: No. 8, 293-296(21 Jun 1975).

It is shown how the assumption of direct coupling of the recently discovered psi particles to leptons and quarks can explain the unexpectedly large production of psi, (3.1 GeV) in nucleon–nucleon scattering in terms of the psi branching ratios observed in the e^+e^- formation experiments. This result favors the interpretation of psi particles as weak intermediate bosons rather than as long-lived hadrons. (JFP)

23354 PROPERTIES OF THE ρ-TRAJECTORY. Kobylinskii, N. A. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 1, 163-165(Jan 1975). (In Russian).

The dependence of the intersection of the ρ trajectory on m is examined. It is concluded that the NN threshold gives the basic contribution to the trajectory. The meson thresholds affect primarily the resonance widths. There is no resonance with spin $J \geq 5$ on the ρ trajectory. (JSR)

Strong (Baryon No. = 1)

Refer also to abstracts 23337 and 23341.

23355 (HU-TFT-74-23) PUZZLE OF THE NEAR-SATURATION OF ISOSPIN BOUNDS IN $\pi N \to \pi N$, $KN \to KN$ and $\pi N \to K\Sigma$. Ervanne, J.; Korkea-aho, M.; Toernqvist, N. A. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 55p. Dep. NTIS (US Sales Only) $5.75.

A detailed analysis of the phenomenon of near-saturation of isospin bounds is performed using available experimental information on $\pi N \to \pi N$, $KN \to KN$ and $\pi N \to K\Sigma$. The puzzle, observed previously mainly in low energy $\pi N \to \pi N$ at 180°, is found to exist also elsewhere, in particular in $KN \to KN$ at 180° and at intermediate angles in terms of the 0_3 invariant bound of Doncel, Michel and Minneart. Because of the widespread occurance of the phenomenon the hypothesis is suggested that it is a general approximate property of nondiffractive scattering. The significance of the effect is studied with a statistical model and the extent to which well known phenomenology can explain it is discussed, but it is concluded that the effect is more general than can be expected from simple arguments. (15 figures, 2 tables) (auth)

23356 (JINR-E2-8695) CONSTRAINTS ON EXPERIMENTAL OBSERVABLES OF THREE ($0\frac{1}{2} \to 0'\frac{1}{2}'$) REACTIONS RELATED BY UNITARY SYMMETRIES. Ion, D. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. Dep. NTIS (US Sales Only) $4.25.

All the constraints on the (differential and integrated) experimental observables of three ($0\frac{1}{2} \to 0'\frac{1}{2}'$) reactions related by the internal symmetries are established. These results improve, in the most general form, all the constraints previously obtained. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 23331 and 23507.

23357 (HU-TFT-74-18) SEMI-INCLUSIVE SCALING FOR LARGE-P_T EVENTS. Finkelstein, J.; Kajantie, K. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Aug 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

Semi-inclusive reactions of the type p + p → (particle with large p_T) + n charged particles + neutrals are considered and a scaling law is proposed for the distribution function of the large-p_T particle produced in association with n charged particles. This scaling rule is shown to be consistent with present information on single-particle spectra and average associated multiplicities at large p_T. It is also shown that if the associated multiplicity were to continue to increase linearly with p_T, then moments of the multiplicity distribution would increase like powers of s. (2 figures) (auth)

23358 BARYON–BARYON SCATTERING IN A ONE-BOSON-EXCHANGE POTENTIAL MODEL. Nagels, M. M. Nijmegen; Katholieke Universiteit (20 Mar 1975). 212p.

Thesis.

The NN reactions pp → pp, pn → pn and the YN reactions $\Sigma^+p \to \Sigma^+p$, (Λp, Σ^+n, Σ^0p), $\Lambda n \to \Lambda n$ and $\Sigma^-p \to (\Sigma^-p, \Sigma^0n, \Lambda n)$ at $T_{lab} \lesssim 350$ MeV are all described by an ϑBEP model with a phenomenological hard core potential for $r \lesssim 0.5$ fm. The local potentials for $r \gtrsim 0.5$ fm are deduced from the exchange of mesons from pseudoscalar and vector meson SU(3) nonets and the scalar ϵ meson, assuming this is an SU(3) singlet. The free parameters in the model, eight coupling constants, four hard core parameters in NN, and two F/(F + D) ratios plus three hard core parameters in YN are determined by an χ^2 fit to experimental data. Those data are total and differential elastic and inelastic cross sections, polarization data, low energy scattering lengths and deuteron parameters. The general agreement is good except for some discrepancies at higher energy. The cusp at the Σ^+n production threshold in the Ap → Ap total cross section is explained, and a big phase shift in the $^1P_1$ (Σ^+p) wave at higher energies is predicted. (auth)

23359 COMPARISON OF PARTONIC AND MULTIPERIPHERAL MODEL PREDICTIONS WITH EXPERIMENT. Levin, E. M.; Ryskin, M. G. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 21: No. 6, 1281-1293(Jun 1975). (In Russian).

The experimental data are compared with the theoretical predictions of the partonic and multiperipheral models concerning the dependence of the inclusive cross section and of the multiplicity upon the transverse momentum (q_t) and energy at large q_t. The same comparison is made for the correlations and relative yields of various particles. Besides, there are considered ρ at large q_t in the fragmentation region and effect of the emission of resonances on the energy and q_t dependence of ρ. (1 table, 10 figures) (auth)

23360 POSSIBLE DESCRIPTION OF THE STRUCTURE IN PP ELASTIC SCATTERING. Semenov, S. V.; Tyurin, N. E. (Inst. of Physics of High Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1316-1321(Jun 1975). (In Russian).

The pp elastic scattering is analysed in the quasipotential model taking into account the structure of the interacting particles. (2 tables, 1 figure) (auth)

Particle Invariance Principles and Symmetries

General

23361 (LA-UR-75-1161) CANONICAL RESOLUTION OF THE MULTIPLICITY PROBLEM FOR U(3): AN EXPLICIT AND COMPLETE CONSTRUCTIVE SOLUTION. Biedenharn, L. C.; Lohe, M. A.; Louck, J. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 10p. (CONF-750650-1). Dep. NTIS $4.00.

From 4th international colloquium of group theoretical methods in physics; Nijmegen, Netherlands (23 Jun 1975).

The multiplicity problem for tensor operators in U(3) has a unique (canonical) resolution which is utilized to effect the explicit construction of all U(3) Wigner and Racah coefficients. Methods are employed which elucidate the structure of the results; in particular, the significance of the denominator functions entering the structure of these coefficients, and the relation of these denominator functions to the null space of the canonical tensor operators. An interesting feature of the denominator functions is the appearance of new, group theoretical, polynomials exhibiting several remarkable and quite unexpected properties. (auth)

Applications (Strong)

23362 (JINR-E2-8696) GOLDSTONE MODE OF SIGMA MODEL IN [1,1] REPRESENTATION OF SU(2) × SU(2) CHIRAL GROUP. Dubnickova, A. Z. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

The spontaneous breakdown of symmetry of the σ-model in the [1,1] representation of SU(2) × SU(2) group is investigated. It is shown that the spontaneous breakdown is realized in all cases of squared mass μ^2 in mass term in the Lagrangian ($\mu^2 > 0$, $\mu^2 = 0$, $\mu^2 < 0$), unlike the σ-model in [½,½] representation, in which the spontaneous breakdown only for the case $\mu^2 < 0$ manifests itself. Further, different but equivalent methods of obtaining of the nonlinear realization for pions in the frame of σ-model extended in such a way are demonstrated. Finally, it is noted that the obtained results can be generalized to all [N/2,N/2] representations of SU(2) × SU(2) chiral group. (auth)

Scattering Theory

Refer also to abstract 23344.

23363 (JINR-E4-8819) SEPARABLE EXPANSION OF POTENTIAL IN MULTI-DIMENSIONAL SPACE. Three-Body Problem. Belyaev, V. B.; Wzecionko, J.; Sakvarelidze, M. I.; Eliava, A. T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

The problem is solved on the 3-particle bound state by the method of separable expansion of the total potential $V = V_{12} + V_{13} + V_{23}$ in the 6-dimensional space. In a concrete calculation for a two-body potential of the Gaussian type, a rapid convergence of the proposed procedure is established. The wave function of the considered system is presented as a series in matrix elements of the potential V, which are explicitly calculated in the given case. The investigation was performed at the Laboratory of Theoretical Physics, JINR. (auth)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

23364 (HU-TFT-74-20) POSSIBLE MODEL STATES FOR THE B PHASE OF SUPERFLUID ^{3}He. Moore, M. A.; Vuorio, M.; Haavasoja, T.; Vidberg, H. J. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Sep 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

Various alternatives to the Balian-Werthamer model of the B phase of superfluid ^{3}He are considered. The linear NMR properties of a certain f-wave state of axial symmetry are shown to be very similar to those required by experiment. (auth)

23365 FORMATION OF NEUTRAL EXCITATIONS IN He II. Kovdrya, Yu. Z.; Rybalko, A. S. (Physical-Technical Inst. of Low Temperatures, Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 1, 158-160(Jan 1975). (In Russian).

Experimental results are reported from which it is concluded that fast electrons form neutral excitations in He II whose behavior is analogous to the neutral excitation caused by α particles. (JSR)

Superconductivity

Refer also to abstracts 22781, 22838, 22840, 22841, 22849, 22850, 22854, 22874, 22876, 22883, and 22887.

23366 (IS-M-37) PHENOMENOLOGICAL THEORY OF THE LOCAL MAGNETIC FIELD IN TYPE-II SUPERCONDUCTORS. Clem, J. R. (Ames Lab., Iowa (USA)). 1975. 4p. (CONF-740857-1). Dep. NTIS $4.00.

From 14th international conference on low temperature physics; Helsinki, Finland (14 Aug 1975).

Recent neutron diffraction experiments have yielded increasingly detailed information about the local magnetic field distribution in single-crystal flux-line lattices in type-II superconductors. Such experiments have shown that this field distribution is accurately represented by a linear superposition of the fields of isolated flux lines, provided the Ginzburg–Landau parameter, kappa, is large and the flux-line spacing is large compared with the coherence length. In this paper it is demonstrated that, within the framework of the Ginzburg–Landau theory, the procedure of obtaining the local magnetic field by a linear superposition of contributions of individual flux lines is valid for arbitrary kappa and flux-line spacings, provided these contributions are calculated using the correct spatially dependent magnitude of the order parameter that is appropriate for the given flux-line spacing; The field contribution of an individual flux line can be approximated with a simple model involving two parameters, a core radius parameter and a field-dependent penetration depth; this model, using only a single fitting parameter, lambda, gives a good semi-quantitative overall description of the neutron diffraction form factors and the corresponding magnetic field distribution in Nb at 4.2K. (1 figure) (RWR)

23367 NEUTRON SCATTERING BY FLUX-LINE LATTICES IN CLEAN, TYPE II SUPERCONDUCTORS. Sacks, R. (Stanford Univ., CA). J. Low Temp. Phys.; 19: No. 3-4, 341-363(May 1974).

The scattering of neutrons by a clean, type II superconductor in the mixed state is studied, using a quantized hydrodynamic theory for the superfluid vortex lattice. If the scattering amplitude is expanded in the number of quanta of vortex waves emitted or absorbed, the resulting inelastic cross section diverges at long wavelengths. Inclusion of inelastic effects to all orders removes this unphysical singularity and yields a differential cross section which differs only slightly from that predicted for elastic scattering. (auth)

23368 DYNAMIC INTERMEDIATE STATE IN THIN SUPERCONDUCTORS. Doll, R. (Bayerischen Akademie der Wissenschaften, Munich); Winter, H. J. Low Temp. Phys.; 19: No. 3-4, 291-316(May 1974).

The superconducting transition of a thin, current-carrying wire at fixed temperature below T/sub c/ has been studied on the basis of the Ginzburg–Landau theory. In the case of solutions uniform in space and in the case of solutions with a longitudinal structure a description of the development in time is given. Taking into account fluctuations of the complex order parameter, in the simplest case of uniformity in space solutions periodic in time at over-critical currents were found. In this case the order parameter, the supercurrent, and the electric field are periodic in time with a well-defined frequency spectrum over a low-level noise spectrum. The electrical resistance is thereby reduced in this region. (auth)

23369 SUPERCONDUCTIVITY AT VERY STRONG COUPLING. Allen, P. B. (Cambridge Univ., Eng.); Dynes, R. C. J. Phys., C (London); 8: No. 9, L158-L163(7 May 1975).

A numerical treatment of the Eliashberg equations reveals that McMillan's equation fails for $\lambda \gtrsim 1.5$. For very large λ, T_c scales as $\sqrt{\lambda \langle\omega^2\rangle}$, while for $\lambda < 1.0$, McMillan's equation is reasonably accurate. A new approximate T_c equation is given which satisfies these limits, and it is shown that the maximum T_c occurs at infinite λ. A new tunnelling measurement for amorphous $Pb_{0.45}Bi_{0.55}$ gives $\lambda = 2.59$ and a T_c in excellent agreement with the numerical solutions. (auth)

23370 PINNING EFFECTS IN VERY REVERSIBLE SUPERCONDUCTORS. Campbell, A. M. (Cambridge Univ., Eng.). Philos. Mag.; 31: No. 5, 1191-1199(May 1975).

When the surface barrier is removed from reversible PbTl specimens, it is found that they do not obey the Bean model in a.c. conditions. The response is nearly linear with large penetrations of the a.c. signal. However, a model which takes into account the reversible oscillations of flux lines can explain the results. Critical current densities obtained from this model agree with those measured by other methods. Critical current densities as low as 4 A/sq cm were found and the factors affecting reversibility are discussed. (auth)

23371 MAGNETOHYDRODYNAMIC DISTURBANCES IN AN ESTUARY. Basu Mallik, S. (Jadavpur Univ., Calcutta). Indian J. Theor. Phys.; 22: No. 2, 51-55(Jun 1974).

A theoretical analysis was carried out for determining the disturbances in an estuary which meets an open sea. The treatment makes use of the electromagnetic equations of Maxwell modified by Lorentz's body force due to the electromagnetic fields induced in the disturbances by their movements through the magnetic field of the earth. Some necessary but simplifying assumptions were made, and it was found that the operational methods facilitate the solution of the problems. (auth)

23372 SUPERCONDUCTIVITY AT INTERFACES. Inkson, J. C. (Cambridge Univ., Eng.). J. Phys., C (London); 8: No. 9, L164-L168(7 May 1975).

The possibility of superconductivity at metal-semiconductor interfaces brought about by exchange of surface plasmons is considered. It is shown using an approximation to the dielectric response in the interface region that the total interaction is less favorable than in the bulk metal. The importance of taking the full interaction rather than isolating the surface plasmons only is stressed. (auth)

23373 THEORY OF MULTIFILAMENTARY FLAT SUPERCONDUCTORS. Glasnik, I. (Elektrotechnicky ustav, Bratislava). Elektrotech. Cas.; 26: No. 4, 259-270(1975). (In Russian).

Calculations are made of eddy currents in the normal metal of a flat multifilamentary superconductor placed in a changing magnetic field with $\vec{B}$ perpendicular to the band plane. On their basis complementary losses, which are caused by these currents, are calculated and compared with losses in the superconductor. In the discussion the validity conditions of the obtained results are determined, the results are compared with analogical results, obtained on the basis of Smith's simplified model for multifilamentary superconductive wires. (auth)

PHYSICS (NUCLEAR)

23374 (COO-3494-25) NUCLEAR REACTION MECHANISMS. Progress Report, June 1974–May 1975. Blann, M. (Rochester Univ., N. Y. (USA). Nuclear Structure Research Lab.). 1975. Contract E(11-1)-3494. 42p. Dep. NTIS $5.25.

Research under the subject contract has been directed along two major lines: (1) Development and exploration of pre-equilibrium statistical models; (2) Experimental measurement and theoretical investigation of heavy ion reaction mechanisms, with emphasis on the limits on compound nucleus formation. Much of the work under this contract has been published and a list of publications is part of this report. This work is not otherwise summarized herein. New unpublished results on heavy ion reactions are briefly summarized, as are results of models relating to nuclear equilibration processes. Colloquia and addresses are also summarized. (auth)

For titles of individual papers see: 23404, 23405, 23411, and 23426.

23375 (NP-20444) ANNUAL REPORT, 1972. Karmohapatro, S. B.; Bhattacharyya, S. B. (eds.). (Saha Inst. of Nuclear Physics, Calcutta (India)). 1972. 168p. Dep. NTIS (US Sales Only) $11.50.

This report contains a resume of the activities of the staff of the Saha Institute of Nuclear Physics in 1972, preceded by a General Introduction by the Director. This introduction is rather lengthy, and refers to specific pieces of work not always mentioned in the body of the text. Brief reports on individual pieces of research are then arranged according to division as follows: Accelerator Group (Cyclic accelerator division, Electrostatic accelerator division, Nuclear chemistry division, Mass spectroscopy and isotope separator), Nuclear Physics Group (Nuclear physics division, Crystallography and molecular biology division, Teaching division), Biophysics Division, Theoretical Nuclear Physics Division, Instrumentation Division, Director's Research Group, and Workshop. A list of staff, detailed index of individual reports, list of publications, etc., are given in the appendixes. Individual reports with a significant amount of information are separately title listed. (RWR)

For titles of individual papers see: 21822, 21823, 21858, 21964–21967, 22016, 22129, 22135, 22283, 22493, 22602, 22990, 23415, 23428–23433; 23457, 23471, 23486, and 23487.

Neutron Interactions with Matter

Refer also to abstracts 23294 and 23295.

23376 (COO-2280-21) QUANTITATIVE AND COMPUTERIZED ERROR ANALYSIS. Progress Report. Bareiss, E. H.; Derstine, K. L. (Northwestern Univ., Evanston, Ill. (USA)). May 1975. Contract AT(11-1)-2280. 35p. (CONF-750312-1). Dep. NTIS $4.75.

From 4th conference on transport theory; Blacksburg, Virginia, USA (10 Mar 1975).

A method is described how a quantitative measure for the robustness of a given transport theory code for coarse network calculations can be obtained. A code that performs this task automatically and at only nominal cost is described. This code also generates user-oriented benchmark problems which exhibit the analytic behavior at interfaces. (4 figures, 1 table) (auth)

23377 (COO-2509-3) KINETIC THEORY OF NEUTRON GASES. Progress Report, October 1, 1974--June 30, 1975. Goldstein, H.; Cacuci, D.; Ku, L. P.; Ostrow, S.; Peng, W. (Columbia Univ., New York (USA). Div. of Nuclear Science and Engineering). 1975. Contract AT(11-1)-2509. 11p. Dep. NTIS $4.00.

Interim progress reports are presented on four investigations involving the transport of fast neutrons. The common theme tying together the four research projects is the manner in which details of microscopic cross sections affect the macroscopic transport behavior of neutron gases in material media. In the first, the classic problem of transport and slowing down in a non-hydrogenous medium with constant cross section is being reexamined, using Case's method of singular eigenfunctions. Both the asymptotic limit derived by Wick and the age-theory extreme have been recovered, and higher order corrections to these are being derived. Semi-numerical techniques have been developed which should permit calculation of the flux over wide ranges of distance and lethargy. The second investigation is the study of the effects of square-well minima in otherwise constant cross sections. A specialized moments-method code has been developed for the purpose, which gives the flux as far out as 80 to 100 mfp from the source. A simple but highly accurate model has been developed to include the effects of the minima, and it is now feasible to predict under what conditions a given minimum will significantly affect the penetration. In the third study Monte Carlo has been used to obtain the characteristics of neutron histories penetrating to various distances and energies in iron. The role of such cross section phenomena as inelastic scattering and cross section minima is being elucidated. In the last investigation, the discrete energy S/sub N/ method is being applied to various transport problems difficult of access by other methods. For example, an examination is under way of the dependence of fast-neutron albedo on the form of representation of the scattered neutron distribution and on the fine structure of the cross section. (auth)

23378 (LA-5990-MS) ONETRAN: A DISCRETE ORDINATES FINITE ELEMENT CODE FOR THE SOLUTION OF THE ONE-DIMENSIONAL MULTIGROUP TRANSPORT EQUATION. Hill, T. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. 70p. Dep. NTIS $5.45.

ONETRAN solves the one-dimensional multigroup transport equation in plane, cylindrical, spherical, and two-angle plane geometries. Both regular and adjoint, inhomogeneous and homogeneous problems subject to vacuum, reflective, periodic, white, albedo or inhomogeneous boundary flux conditions are solved. General anisotropic scattering is allowed and anisotropic inhomogeneous sources are permitted. The discrete ordinates approximation for the angular variable is used with the diamond (central) difference approximation for the angular extrapolation in curved geometries. A linear discontinuous finite element representation for the angular flux in each spatial mesh cell is used. Negative fluxes are eliminated by a local set-to-zero and correct algorithm. Standard inner (within-group) iteration cycles are accelerated by system rebalance, coarse-mesh rebalance, or Chebyshev acceleration. Outer iteration cycles are accelerated by coarse-mesh rebalance. Provision is made for creation of standard interface output files for S/sub N/ constants, inhomogeneous sources, angle-integrated fluxes, and angular fluxes. Standard interface input files for S/sub N/ constants, inhomogeneous sources, cross sections, and total or angular fluxes may be read. All binary operations are localized in subroutines REED and RITE. Flexible edit options, including restart capability are provided. ONETRAN is designed for use with CDC-7600 and IBM 360. (12 tables, 10 figures) (auth)

23379 CONVERGENT CENTERED DIFFERENCE SCHEMES FOR THE DISCRETE ORDINATE NEUTRON TRANSPORT EQUATIONS. Madsen, N. K. (Univ. of California, Livermore). SIAM (Soc. Ind. Appl. Math.) J. Numer. Anal.; 12: No. 2, 164-176(Apr 1975).

The weighted central difference approximations for the discrete ordinate neutron transport equations are described and analyzed. Stability and second order convergence in a discrete L_2-norm for a subclass of the methods are established. It is also noted that some of the difference schemes are nonnegative. Numerical results are presented. (7 figures) (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstract 23450.

23380 (JINR-P1-8954) SCATTERING OF CHARGED PIONS ON ^{4}He NUCLEI IN THE ENERGY RANGE OF 68 TO 208 MeV. Shcherbakov, Yu. A.; Aleksandrov, L.; Angelesku, T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

New data on differential cross sections of elastic scattering of charged pions on ^{4}He nuclei are presented. The data have been obtained in experiments with helium filled streamer chamber of high pressure at the synchro-cyclotron of the Laboratory of Nuclear Problems, JINR. The data on phase analysis, dependent on energy, are presented. Comparison with optical model predictions is carried out. (6 figures, 2 tables) (auth)

23381 (JINR-P1-8955) ELASTIC $\pi^\pm$ MESON SCATTERING ON ^{3}He NUCLEI IN THE ENERGY RANGE OF 68 TO 208 MeV. Shcherbakov, Yu. A.; Angelesku, T.; Kulyukin, M. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Differential cross sections of elastic π meson scattering on ^{3}He nuclei at energies of 68, 98, 120, 135, 145, 156, 198, 208 MeV have been measured. The experiments have been performed with the filled streamer chamber at high pressure. Data are compared with optical model calculations. Estimations of the $f^2(\pi,^3He,^3H)$ coupling constant are given. (2 tables, 7 figures) (auth)

23382 (JINR-P2-8827) π^4He-SCATTERING IN THE GLAUBER REPRESENTATION. Atanasov, A.; Velikov, V.; Geogresku, K.; Nikitiu, F.; Shcherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The differential and total cross sections of π^4He-scattering have been calculated on the basis of the Glauber approach using nonrelativistic and relativistic kinematics. The cross sections calculated are compared with experimental data on elastic scattering obtained at 68, 97 and 154 MeV. (4 figures) (auth)

23383 (NP-20482, pp 12; 14-15) PHOTONEUTRON ENERGY SPECTRA FROM ^{16}O AND ^{2}D. Devos, J.; Van de Vyver, R.; Carchon, R.; Van Camp, E. 1974.

In Nuclear Physics Laboratory annual report, 1974.

23384 (NP-20508, pp 32) ELASTIC PROTON–DEUTERON SCATTERING. Johansson, A.; Sundqvist, B.; Amten, L.; Glantz, L.; Goenczi, L.; Koersner, I. (Tandem Accelerator Lab., Uppsala). Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23385 (NP-20508, pp 32-33) ELASTIC NEUTRON–DEUTERON SCATTERING. Johansson, A.; Sundqvist, B.; Amten, L.; Glantz, L.; Goenczi, L.; Koersner, I.; Nilsson, L. (Tandem Accelerator Lab., Uppsala). Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23386 (NP-20508, pp 33-35) ANALYSIS OF THE d(p,2p)n REACTION. Johansson, A.; Sundqvist, B.; Amten, L.; Glantz, L.; Goenczi, L.; Koersner, I.; Nilsson, L. (Tandem Accelerator Lab., Uppsala). Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

Nuclear Properties and Reactions, $6 \leq A \leq 19$

Refer also to abstracts 23327, 23383, and 23402.

23387 (CEA-CONF-3010) PERTURBATION THEORY WITH A SOFT CORE TWO NUCLEON INTERACTION. Gogny, D.; Maire, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). 1975. 2p. (CONF-750233-2). Dep. NTIS (US Sales Only) $4.00.

From conference on Hartree-Fock and self-consistent field theories in nuclei; Trieste, Italy (24 Feb 1975).

The realistic soft-core two-nucleon interaction of Gogny, Pires, and de Torreil was used with ordinary perturbation theory to calculate the binding energy, density, radius, and separation energy of ^{16}O, ^{40}Ca, ^{90}Zr, and ^{208}Pb. The expansion is to second order, with a Hartree–Fock basis including all states containing up to five modes. Values are also given for nuclear matter. (2 tables) (RWR)

23388 (CEA-CONF-3011) SELF CONSISTENT R. P. A CALCULATION WITH THE FINITE RANGE AND DENSITY DEPENDENT INTERACTION "D 1". Blaizot, J. P.; Gogny, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique; CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1975. 2p. (CONF-730815-8). Dep. NTIS (US Sales Only) $4.00.

From international conference on nuclear physics; Munich, F. R. Germany (27 Aug 1973).

Preliminary results of a random phase approximation calculation on oxygen 16 with the particle–hole interaction derived from a previous interaction is presented. The energy levels are drawn. The giant dipole resonance is found at 22.7 and 24.7 MeV. Also a 0^+ T = 0 state is found at 22 MeV and a 2^+ state is found at 21 MeV. It is found that all eigenvalues are real, meaning that the Hartree–Fock solution is stable against all particle–hole excitations. (JFP)

23389 (COO-3001-118) APPLICATION OF THE EXP(S)-METHOD TO EFFECTIVE INTERACTIONS IN NUCLEI. Offermann, R.; Ey, W.; Kuemmel, H. (State Univ. of New York, Stony Brook (USA); Bochum Univ. (F. R. Germany). Inst. fuer Theoretische Physik; Max-Planck-Institut fuer Chemie (Otto-Hahn-Inst.), Mainz (F. R. Germany). Kernphysikalische Abt.). 1975. Contract AT(11-1)-3001. 46p. Dep. NTIS $5.50.

The exp(s)-method--applied before to ground states of doubly magic nuclei only--is extended to open shell nuclei. Cellular type approximations are made and justified. A comparison with perturbation theory is made using ^{16}O as an example. A new grouping of the (folded) diagram expansion is obtained and seems to be favored by the numerical results. (auth)

23390 (HU-TFT-74-26) EFFECT ON $\alpha-\alpha$ BREMSSTRAHLUNG OF RESONANCES IN ^{8}Be. Green, A. M.; Niskanen, J. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The effect of the quadrupole transition between the ^{8}Be states 4^+(11.4 MeV) and 2^+(2.9 MeV) is included in low energy $\alpha-\alpha$ bremsstrahlung ($E_{lab} < 30$ MeV). In the equal angle Harvard geometry this dominates for $\theta < 30°$, and so enables an estimate to be made of $B(E2,4^+ \rightarrow 2^+, {}^8Be)$. The problem of non-coplanarity is also discussed. (6 figures) (auth)

23391 (KFK-2127) EMPIRICAL STUDIES OF THE EFFECTIVE INTERACTION AND OF EXCHANGE EFFECTS FOR THE FOLDING MODEL APPROACH OF 104 MeV α-PARTICLE SCATTERING. Gils, H. J.; Rebel, H. (Kernforschungszentrum Karlsruhe (F. R. Germany)). May 1975. 43p. Dep. NTIS (US Sales Only) $5.25.

Differential cross sections of elastic 104 MeV α-particle scattering from several target nuclei between ^{12}C and ^{116}Sn have been analyzed by a semimicroscopic folding model in order to obtain an adequate normalization of the effective nucleon-α-interaction and to study the influence of the normalization on the extracted rms-radii of the nuclear matter. By additionally introducing an effective exchange potential we studied the dependence of the matter parameters on exchange effects. Furthermore the exchange potential was applied to the inelastic scattering from ^{20}Ne, ^{56}Fe, ^{58}Ni, ^{60}Ni, ^{90}Zr, and ^{116}Sn. No significant deviations between deformation parameters and rms-radii, respectively, extracted with and without exchange potential could be observed. Isoscalar transition rates have been determined and have been compared to results from different methods. (auth)

23392 (LA-UR-75-1278) PARITY VIOLATION IN P--P AND P--Be REACTIONS. Nagle, D. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 8p. (CONF-750636-2). Dep. NTIS $4.00.

From 5th international conference on neutrino science; Balaton, Hungary (16 Jun 1975).

The observation of a violation of the parity symmetry in two-nucleon systems implies the presence of a weak hadronic force. The positive effect reported by Lobashov in the reaction np yields d gamma, for the circular polarization of the gamma ray, would imply a large value for the parity nonconserving (PNC) amplitude. A transmission experiment has been undertaken for 15-MeV longitudinally polarized protons on hydrogen. A transmission experiment for 6-GeV polarized protons on Be and on H_2O is in progress at the ZGS at Argonne National Laboratory. The current results of the latter two experiments are summarized, and the relation to theoretical calculations is discussed. (2 figures, 1 table) (auth)

23393 (LBL-3861) PRODUCTION OF ^{11}C BY THE INTERACTION OF 375 MeV/amu Ne^{10+} IONS WITH CARBON. Smith, A. R.; Thomas, R. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-eng-48. 9p. Dep. NTIS $4.00.

The reaction cross section for production of ^{11}C from ^{12}C in a polystyrene target has been measured with incident 375-MeV/amu Ne^{10+} ions at the Lawrence Berkeley Laboratory's Bevalac. A broad beam irradiation was used, and both beam profile and absolute particle fluence were determined with LiF thermoluminescent dosimeters, which had been calibrated by track counting in nuclear emulsions; the induced target activity was measured with a NaI(Tl)-crystal, gamma-ray spectrometer. The reaction cross section was 75 ± 7 mb. (1 figure, 1 table) (auth)

23394 INVESTIGATION OF THE REACTION OF ^{6}Li (e,e'p) AT THE ENERGY OF 1200 MeV. Antuf'ev, Yu. P.; Agranovich, V. L.; Kuz'menko, V. S.; Sorokin, P. V. (Physical-Technical Inst., Tashkent). Yadern. Fiz.; 21: No. 6, 1206-1214(Jun 1975). (In Russian).

Dependence of cross section of the reaction ^{6}Li(e,e'p) on the missing energy B is measured by means of magnetic spectrometers, scintillation counters and fast electronics, including the time-amplitude convertors. Two peaks are observed in the spectrum at the energies B = 3.5 ± 1.0 and 19 ± 1 MeV. At these energies the dependence on the proton emission angle is mea-

sured. Comparison with the calculation based on the shell model in the impulse approximation enables one to obtain parameters of the harmonic oscillator function for the p and s shells in the ^{6}Li nucleus: q_p = (50 ± 5) MeV/c; q_s = (108 ± 9) MeV/c. The reduction coefficients are D_s = 0.52 ± 0.07; D = 0.74 ± 0.05, respectively. (6 figures, 3 tables) (auth)

23395 INVESTIGATION OF THE α-PARTICLE STRUCTURE OF EXCITED STATES OF THE NUCLEUS ^{20}Ne. Artemov, K. P.; Gol'dberg, Z. Z.; Petrov, I. P.; Rudakov, V. P.; Serikov, I. N.; Timofeev, V. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1157-1168(Jun 1975). (In Russian).

Angular dα correlation in the process ^{16}O(^{6}Li, d)^{20}Ne (α) ^{16}O is measured at the ^{6}Li-ion energy of 28 MeV. It is shown that in the nucleus ^{20}Ne there exist states having some manifest α-cluster properties: they are populated as a result of direct α-particle transfer, the dominating decay mode of these states is the α decay to the ground state of ^{16}O, the reduced α-particle widths of these states are near the Wigner limit. A number of these states may be identified with previously known levels of ^{20}Ne, involved in the rotational bands of this nucleus. Characteristics of some states are determined for the first time. The obtained data enable one to specify the classification of the rotational bands in ^{20}Ne. (2 tables, 3 figures) (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 23391, 23395, and 23450.

23396 (COO-3126-29) NEUTRON-ABSORPTION CROSS SECTION OF SODIUM-22. Rundberg, R.; Elgart, M. F.; Finston, H. L.; Williams, E. T.; Bond, A. H. Jr. (Brooklyn Coll., N.Y. (USA)). 1975. 3p. (CONF-750303-70). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

A simple method for determining the neutron-absorption cross sections for radionuclides produced and consumed in a reactor-neutron flux is described. Data were obtained for ^{22}Na which, through application of Westcott's procedure, yielded the following: sigma$_0$ equals 51.5 +- 3.1 kbarns, s_0 equals 2.3 +- 0.1, and SIGMA' equals 100 +- 10 kbarns. (3 tables) (auth)

23397 (COO-3496-50, pp 91-96) STATISTICAL DESCRIPTION OF INTERACTING FERMIONS INCLUDING ANGULAR MOMENTUM. Behkami, A. N. (Pahlavi Univ., Shiraz, Iran); Huizenga, J. R. (Pahlavi Univ., Shiraz, Iran). 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23398 (NP-20508, pp 37-38) γ DECAY OF THE T = ½, J^π = ½$^+$ LEVEL IN ^{23}Na. Christiansson, J. E.; Dubois, J.; Jarneborn, L.; Odelius, H.; Roth, H.; Skarp, K. (Chalmers Univ. of Tech., Goteborg). Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23399 (NP-20508, pp 46-49) NEUTRON CAPTURE REACTIONS IN THE GIANT RESONANCE REGION. Bergqvist, I. (Univ. of Lund, Sweden); Palsson, B.; Lindholm, A.; Nilsson, L. Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23400 TABLES FOR REACTION GAMMA-RAY SPECTROSCOPY. II. A equals 21 to A equals 32. de Meijer, R. J. (Univ. of Groningen, Netherlands); Drentje, A. G.; Plendl, H. S. At. Data Nucl. Data Tables.; 15: No. 5, 391-442(May 1975).

Observed gamma-ray transitions from bound and nearly bound levels of all known nuclides in the mass range A equals 21 to A equals 32 are tabulated for use in reaction (on-line, in-beam) gamma-ray spectroscopy. The tables present energies, spins, and parities of the nuclear levels, the transition (photopeak) energy corrected for recoil, the corresponding Compton edge and escape peaks, as well as competing decays, mean lives, and branching ratios when known. The information is arranged in order of both increasing gamma-ray energy and nuclide mass number. The literature cutoff date is Aug. 15, 1974. (2 tables) (auth)

23401 DETECTION OF A GROUP OF HIGH-LYING α-CLUSTER STATES IN NUCLEUS ^{28}Si. Artemov, K. P.; Gol'dberg, V. Z.; Petrov, I. P.; Rudakov, V. P.; Timofeev, V. A.; Vol'ski, R.; Shmider, Ya. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1169-1177(Jun 1975). (In Russian).

Angular dα correlation in process ^{24}Mg(^{6}Li, d)^{28}Si(α)^{24}Mg is measured at the ^{6}Li energy of 24.5 MeV. It is found that in the nucleus ^{28}Si at the excitation energy 15–23 MeV there exist states having manifest α-cluster properties. Spins, parities and reduced α-particle widths of these states are determined. (4 figures, 1 table) (auth)

23402 FORMATION OF A POLARIZED TARGET BY COATING WITH POLARIZED LITHIUM ATOMS. Van Staden, J. Heidelberg; Univ. Heidelberg (1973). 71p. (In German). INIS.

Thesis.

The reactions ^{16}O(^{7}Li,t)^{20}Ne, ^{16}O(^{6}Li,d)^{20}Ne and ^{17}O(^{6}Li,t)^{20}Ne were performed at incident energies between 25 and 38 MeV. The structures of the selectively excited states in ^{20}Ne are discussed with the aid of the particle–hole model. Two levels are excited strongly at an excitation energy of 21–22 MeV. These levels are the expected $J = 10^+$ and $J = 9^-$ members of the $K = 0^+$ and $K = 0^-$ rotational bands. The excitation functions for the ^{16}O(^{7}Li,t)^{20}Ne reaction were calculated by a semiclassical method with the help of angular momentum adjustment. For that reason the levels must have spins greater than 8 at 22 MeV. Angular correlation measurements were made. The state at 15.64 MeV was determined as a $J = 7^-$ member of the $K = 0^-$ rotational band. (36 figures, 7 tables) (GE)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 23387, 23391, 23397, 23432, 23433, and 23511.

23403 (CEA-CONF-3039) SHELL STRUCTURE OF THE ^{58}Ni CHARGE DENSITY. Sick, I.; Bellicard, J. B.; Bernheim, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1975. 2p. (CONF-750233-3). Dep. NTIS (US Sales Only) $4.00.

From conference on Hartree-Fock and self-consistent field theories in nuclei; Trieste, Italy (24 Feb 1975).

A very high momentum transfer electron elastic scattering experiment has been performed at Saclay. These data were analyzed to obtain the ^{58}Ni charge density with errors of ±1%. The experimental result is compared with different Hartree–Fock densities. Density-dependent potentials seem to do better than velocity-dependent ones. (2 figures) (RWR)

23404 (COO-3494-25, pp 22-27) PRECOMPOUND ANALYSIS OF (p,n) REACTIONS. Galonsky, A.; Patterson, D. M.; Doering, X.; Blann, M. 1975.

In nuclear reaction mechanisms. Progress report, June 1974–May 1975. (Rochester Univ., N.Y. (USA). Nuclear Structure Research Lab.).

23405 (COO-3494-25, pp 28-38) PREEQUILIBRIUM DECAY CALCULATIONS: A GENERAL MODEL APPROACH. Mignerey, A.; Scobel, W.; Blann, M. 1975.

In nuclear reaction mechanisms. Progress report, June 1974–May 1975. (Rochester Univ., N.Y. (USA). Nuclear Structure Research Lab.).

23406 (NP-20508, pp 43-45) PROPOSED BAND STRUCTURE IN ^{54}Mn. Alenius, G.; Arnell, S. E.; Selin, E.; Stankiewicz, O. (Chalmers Univ. of Tech., Goteborg). Jan 1975.

In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23407 SPECTROSCOPY OF ^{50}V WITH (p,nγ) REACTION. Gupta, S. K.; Saini, S.; Namjoshi, L. V.; Mehta, M. K. (Bhabha Atomic Research Centre, Bombay). Pramana.; 5: No. 1, 37-47 (Jul 1975).

Information on the low-lying levels up to ~1.9 MeV excitation of the doubly odd nucleus ^{50}V was obtained through the Ge(Li)–Ge(Li) coincidence study with the ^{50}Ti(p, nγ)^{50}V reaction. Branching ratios were measured and tentative spin–parity assignments were made. A detailed comparison with other measurements reported recently was also made. By using the lowest seniority wave functions with $(f_{\frac{7}{2}})^3_{\frac{7}{2}}$ $(f_{\frac{5}{2}})^{-1}_{\frac{5}{2}}$ configuration, energy levels and electromagnetic properties were calculated. These are compared with the present and earlier experimental data. (3 figures, 3 tables) (auth)

23408 PHOTOPROTON REACTIONS NEAR THRESHOLD. Ratner, B. S. (Inst. of Nuclear Research, Novosibirsk, USSR). Yadern. Fiz.; 21: No. 6, 1147-1153(Jun 1975). (In Russian).

The yield of the (γ, p) reaction is studied on ^{62}Ni, ^{64}Ni and ^{53}Cr nuclei in the near threshold energy range of $E_{\gamma\,max}$. A

considerable difference of the shapes of the curves, of the yields and of the observable threshold is found for Ni isotopes and ^{53}Cr nucleus. (2 tables, 5 figures) (auth)

23409 PROTON HOLE STATES EXCITED BY MONOENERGETIC GAMMA QUANTA. Wene, C. O. (Lund Univ. (Sweden). Dept. of Nuclear Physics). Z. Phys., A; 272: No. 1, 77-87(1975).

The high energy photoproton spectra from ^{45}Sc, ^{51}V, ^{59}Co, ^{58}Ni, ^{63}Cu and natural nickel have been measured with 60-120 keV resolution using the 17.62 MeV γ-quanta produced by the ^{7}Li (p,γ)^{8}Be-reaction. The absolute cross sections for transitions to levels in the daughter nucleus have been determined. The results are compared with a simple model assuming a semi-direct reaction proceeding via a dipole doorway state. Good correlation is found between the cross sections and the spectroscopic factors measured in proton pick-up reactions. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 23327, 23391, 23405, 23408, 23418, 23421, 23423, 23432, 23433, 23450, 23478, 23484, and 23511.

23410 (ANL/NDM-14) CROSS SECTIONS FOR THE ^{66}Zn-(n,p)^{66}Cu, ^{113}In(n,n')/sup 113m/In AND ^{115}In(n,n')/sup 115m/In REACTIONS FROM NEAR THRESHOLD TO 10 MeV. Smith, D. L.; Meadows, J. W. (Argonne National Lab., Ill. (USA)). Jul 1975. 42p. Dep. NTIS $5.25.

Activation techniques were used in the measurement of cross sections for the ^{66}Zn(n,p)^{66}Cu, ^{113}In(n,n')/sup 113m/In and ^{115}In-(n,n')/sup 115m/In reactions from near threshold to 10 MeV. The ^{7}Li(p,n)^{7}Be and D(d,n)^{3}He reactions were employed as sources of approximately monoenergetic neutrons. Neutron fluence was measured with a fission chamber which contained calibrated uranium deposits enriched in ^{235}U or ^{238}U. Gamma-ray activities of the irradiated samples were measured with NaI(Tl) scintillation and Ge(Li) detectors. The raw data were corrected for various experimental effects including activity decay, detector efficiencies, geometry, absorption, multiple scattering, internal conversion, deadtime, sum coincidences, and sample and uranium deposit properties. The response of the monoenergetic cross section data in reference neutron fields characteristic of thermal fission of ^{235}U and spontaneous fission of ^{252}Cf was numerically investigated. The results of our work are compared with corresponding information reported in the literature. (9 figures, 12 tables) (auth)

23411 (COO-3494-25, pp 11-13) REACTIONS OF ^{40}Ar + ^{109}Ag AND OF ^{84}Kr + ^{65}Cu. Britt, H. C.; Erkkila, B.; Stokes, R. H.; Guthrod, H. H.; Plasil, F.; Ferguson, R. L.; Blann, M. 1975.

In nuclear reaction mechanisms. Progress report, June 1974-May 1975. (Rochester Univ., N.Y. (USA). Nuclear Structure Research Lab.).

23412 (COO-3496-50, pp 3-10) TWO-NEUTRON TRANSFER ON EVEN-EVEN OSMIUM NUCLEI. Thompson, R. C. (Eastman Kodak Co., Rochester, NY); Boyno, J. S.; Huizenga, J. R.; Burke, D. G.; Elze, Th. W. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974-1 June 1975. (Rochester Univ., N. Y. (USA)).

23413 (IFA-DNBR-15-1975) OPTICAL MODEL NEUTRON CROSS SECTIONS CALCULATIONS FOR ^{63}Cu, ^{65}Cu AND NATURAL Cu IN THE ENERGY RANGE 1-15 MeV. Iliescu, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 38p. Dep. NTIS (US Sales Only) $5.00.

The theory of optical model and cross sections is developed. The neutron reactions considered in the high energy range (0.1-15 MeV) were: total, elastic, elastic angular distributions, nonelastic, inelastic for resolved levels. This region was subdivided into two parts: in the first one, ranging from 0.1 to 1 MeV, the evaluation was mainly based on empirical fits of the experimental data, whereas in the second part the fits were carried out with theoretical models: optical and statistical. The potential parameters were obtained fitting the total, elastic, inelastic cross sections and elastic angular distributions. Using Hauser-Feshbach theory, angular distribution and cross sections for compound elastic scattering and inelastic scattering are calculated. (9 figures, 4 tables) (auth)

23414 (JINR-P15-8810) γ-DECAY OF $p_{\frac{1}{2}}$, $f_{\frac{5}{2}}$, $p_{\frac{3}{2}}$ ANALOG RESONANCES IN ^{63}Cu. Kraft, O. E.; Naumov, Yu. V.; Parzhitskii, S. S.; Sizov, I. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The gamma-decay of the analog resonances in ^{63}Cu was investigated. The measurements were performed with the Van de Graaff accelerator ($E_{p,max}$ = 5 MeV) of the Neutron Physics Laboratory of JINR. The resonances at the E_p = 2481, 2546, 2556, and 2659 keV were identified as $p_{\frac{1}{2}}$, $f_{\frac{5}{2}}$ (two components), and $p_{\frac{3}{2}}$ analog states of the ground, first and second excited states of ^{63}Ni. The gamma spectra were measured with Ge(Li) detectors, and partial gamma widths were deduced. It was found that the M1 strength is concentrated in the excitation energy around 3 to 4 MeV. The strength of the analog-antianalog and analog-core-polarization state transitions are discussed. The analog β and γ transitions are compared. (3 figures, 3 tables) (auth)

23415 (NP-20444, pp 13-15) EXCITED LEVELS IN ^{85}Sr. Basu, S. K.; Patro, A. P. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23416 (NP-20507, pp 57-61) ENERGY SPECTRUM OF DELAYED NEUTRONS FROM BROMINE-87. Ohm, H.; Kratz, K. L.; Rudolph, W. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23417 (NP-20507, pp 62-66) COMPARISON OF EXPERIMENTAL AND THEORETICAL FLUCTUATIONS IN THE SPECTRA OF THE DELAYED NEUTRONS FROM ^{85}As, ^{87}Br, ^{135}Sb, AND ^{137}I. Shihab-Eldin, A. A.; Nuh, F. M.; Prussin, S. G.; Franz, H.; Rudolph, W.; Kratz, K. L. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23418 NUCLEAR DATA SHEETS FOR A equals 78. Urone, P. P. (State Univ. of New York, Stony Brook); Bertrand, F. E. (State Univ. of New York, Stony Brook). Nucl. Data Sheets.; 15: No. 2, 107-136(Jun 1975).

The 1966 version of Nuclear Data Sheets for A equals 78 was revised on the basis of all experimental data received before September 1, 1974. Experimental data, detailed level schemes, and arguments for J/sup pi/ assignments are presented. Two new isotopes, ^{78}Ga and ^{78}Rb, are now known to exist; and a third, ^{78}Sr, has been tentatively identified. A significant amount of new information is given for the ^{78}Se, ^{78}Br, and ^{78}Kr level schemes, while very little new information is available for the level schemes of ^{78}Ge and ^{78}As. (auth)

23419 NUCLEAR DATA SHEETS FOR A equals 79. Urone, P. P. (State Univ. of New York, Stony Brook); Kocher, D. C. Nucl. Data Sheets.; 15: No. 3, 257-287(Jul 1975).

The 1966 version of Nuclear Data Sheets for A equals 79 was revised on the basis of experimental data received prior to December 1, 1974. Information from approximately 85 papers and communications was included in the present evaluation. Data on eight A equals 79 nuclei are presented. The half-life and decay energy for ^{79}Ga have been proposed, but the compilers do not regard the nuclidic assignment as firmly established. The existence of two isomers in ^{79}Ge has recently been proposed. The compilers tentatively assign a 42-s activity to the ^{79}Ge ground state, and a partial decay scheme is given. The compilers do not regard the assignment of a 19.1-s activity to ^{79}Ge as firmly established. The spin of the ^{79}As ground state is known from its decay to levels in ^{79}Se. Many levels from ^{79}Se are known from ^{79}As decay, single-nucleon transfer, and a level scheme for ^{78}Se(th n,gamma) proposed by the compilers. Only an upper limit for the half-life of long-lived ^{79}Se has been determined; this nucleus decays directly to the ^{79}Br ground state. Levels in stable ^{79}Br up to 2 MeV are known from ^{79}Kr decay, Coulomb excitation and resonance fluorescence, and (n,n'gamma). Most of the information on excited levels in ^{79}Kr is regarded by the compilers as tentative, since the ^{79}Rb decay scheme is not well established and all reaction studies are unpublished. Only the ground state of ^{79}Rb is known, and its spin cannot be determined since the intensity of the decay to the ^{79}Kr ground state is not accurately known. The compilers tentatively assign an 8.1-m activity to the ^{79}Sr ground state, but no decay scheme has been proposed. The compilers regard the assignment of a 4.4-m activity to ^{79}Sr as not firmly established. The only data on excited levels of ^{79}Sr are unpublished. (auth)

23420 NUCLEAR DATA SHEETS FOR A equals 80. Greenwood, L. R. (Northwestern Univ., Evanston, IL). Nucl. Data Sheets.; 15: No. 3, 289-313(Jul 1975).

The 1966 version of the Nuclear Data Sheets was revised according to experimental data received prior to June 1974, including about 80 papers. Data are presented for eight nuclei (Ga, Ge, As, Se, Br, Kr, Rb, and Sr). No excited states are known in As, although gamma activity has been assigned from Ge decay. Information on Se is available from As (16.5 s) decay, Br (17.4 m) decay, inelastic scattering, and Coulomb excitation. The Se level scheme includes 36 levels (22 J/sup pi/ assignments). Data on the Br level

scheme consist of an isomeric decay (4.4 h) and reaction data and include 44 levels (14 J/sup pi/ values). The Kr level scheme consists of 7 levels (7 J/sup pi/ values) based on data from Br (17.4 m) decay, Rb (34 s) decay, (xngamma), and Coulomb excitation. The Sr (100 m) decay scheme establishes only the first-excited state in Rb. Only the ground-state rotational band up to J/sup pi/ equals 6^+ is known for Sr based on (xngamma) data. Very few charged-particle reaction data are available except for (d,p) and (p,n) to Br. (auth)

23421 NUCLEAR DATA SHEETS FOR A equals 81. Lemming, J. F. (Ohio Univ., Athens). Nucl. Data Sheets.; 15: No. 2, 137-167(Jun 1975).

Level schemes and decay characteristics are presented for all nuclei with mass number 81. Experimental data, adopted values, comparisons with theory, and arguments for spin and parity assignments are given. The adopted level schemes and decay properties are based on data received before July 1, 1974. (auth)

23422 NUCLEAR DATA SHEETS FOR A equals 82. Lemming, J. F. (Ohio Univ., Athens); Auble, R. L. Nucl. Data Sheets.; 15: No. 3, 315-334(Jul 1975).

Level schemes and decay characteristics are presented for all nuclei with mass number 82. Experimental data, adopted values, comparisons with theory, and arguments for spin and parity assignments are given. The adopted level schemes and decay properties are based on data received before November 1, 1974. (auth)

23423 NUCLEAR DATA SHEETS FOR A equals 83. Kocher, D. C. (Oak Ridge National Lab., TN). Nucl. Data Sheets.; 15: No. 2, 169-201(Jun 1975).

The 1966 version of Nuclear Data Sheets for A equals 83 was revised on the basis of experimental data received prior to November 1, 1974. Information from approximately 90 papers and communications was included in the present evaluation. Data on nine A equals 83 nuclei are presented. This A-chain is characterized by a paucity of reaction data compared with radioactive decay data. For ^{83}Ge only the half-life is known. For ^{83}As, the half-life is known but few details of the decay scheme have been determined. The decay schemes of the ^{83}Se ground state and first-excited state are reasonably well established, and levels in ^{83}Se are known from (d,p). The decay schemes of ^{83}Br and ^{83}Rb are well established, and these decays give all adopted information on levels in stable ^{83}Kr. The complex decay scheme for ^{83}Sr is reasonably well established, which leads to all information on levels in ^{83}Rb. Information on ^{83}Sr levels is obtained from ^{83}Y decays and (d,t). The decay schemes for two ^{83}Y isomers have been reasonably well determined, but the ordering of the isomers is not known. The compilers regard the identification of ^{83}Zr as uncertain. This compilation is divided into three parts appearing in the following order: Drawings, Sheets, References. (auth)

23424 GAMMA DECAY OF ^{64,66,68,70}Zn ENERGY LEVELS AND LIFETIME OF THE 0^+ LEVEL OF ^{70}Zn. Blumenberg, F. E. Bonn; Univ. Bonn (1973). 58p. (In German). INIS.

Thesis.

The γ-energy-level transitions of the zinc isotopes are measured by high-resolution (p,pγ) coincidence measurements at E(p) = 8 MeV. ^{64,66,68}Zn are studied to an excitation energy of 3.5 MeV; and ^{70}Zn, to 3.1 MeV. In the case of ^{66}Zn there are 4 and in ^{68}Zn, 5 new energy levels identified. The properties of the energy levels of all Zn isotopes are determined by (t,p) reactions, inelastic scattering and γ-decay as far as possible. (GE)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 21812, 23387, 23391, 23404, 23405, 23410–23412, 23417, 23451, 23478, 23484, and 23491.

23425 (CEA-R-4676) EVALUATION OF THE NUCLEAR CROSS SECTIONS FOR THE REACTIONS ^{93}Nb(n,2n)^{92m}Nb AND ^{93}Nb(n,2n)^{92}Nb FROM THRESHOLD TO 20 MeV. Philis, C.; Young, P. G. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92- Montrouge (France)). Jul 1975. 80p. (In French). Dep. NTIS (US Sales Only) $8.00.

A preliminary evaluation of the nuclear cross section for the reactions ^{93}Nb(n,2n)^{92m}Nb and ^{93}Nb(n,2n)^{92}Nb has been completed from threshold to 20 MeV. The evaluation is based entirely on experimental results. The recommended values were determined after analysis, selection, and normalization of the measurements to a consistent set of standards. The evaluated data are discussed and compared with theoretical values and estimates of the uncertainty in the adopted data are provided. (13 figures, 67 references) (auth)

23426 (COO-3494-25, pp 14-17) ACTIVATION CROSS SECTIONS FOR REACTIONS OF ^{109}Ag INDUCED WITH ^{40}Ar IONS. Hille, M.; Hille, P.; Gutbrod, H. H.; Blann, M. 1975.

In nuclear reaction mechanisms. Progress report, June 1974–May 1975. (Rochester Univ., N.Y. (USA). Nuclear Structure Research Lab.).

23427 (JINR-P15-8917) FISSION OF HEAVY NUCLEI INDUCED BY STOPPED NEGATIVE PIONS. Batusov, Yu. A.; Ganzoring, Zh.; Otgonsuren, O.; Chultem, D. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

By using a mica detector technique relative fission probabilities of 15 heavy nuclei from Ag to U in negative pion capture were determined. It is shown that, for nuclei with $(Z-1)^2/A$ ~30, ~25, and ~20, the fission probabilities are ~10^3, ~10^5, and ≥10^6 times lower than for thorium and uranium isotopes. (3 figures, 1 table) (auth)

23428 (NP-20444, pp 12-13) DISINTEGRATION OF ^{109g}Pd. Chatterjee, M. B.; Baliga, B. B. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23429 (NP-20444, p 31) ENERGY LEVELS ON ^{94}Zr FROM THE DECAY OF ^{94}Y. Singh, H.; Tikku, V. K.; Sethi, B.; Mukherjee, S. K. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23430 (NP-20444, p 31) DECAY OF 40-MIN ^{123m}Sn. Tikku, V. K.; Singh, H.; Sethi, B. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23431 (NP-20444, p 32) DECAY OF 6.2 MIN ISOMER OF ^{130}Sb. Tikku, V. K.; Singh, H.; Sethi, B. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23432 (NP-20444, pp 120-121) NUCLEAR STRUCTURE STUDIES IN REACTIONS. Mukherjee, S.; Chatterjee, A. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23433 (NP-20444, pp 124-126) NUCLEAR DEFORMATION PARAMETERS. Mukherjee, S.; Chatterjee, A. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23434 (NP-20482, pp 16; 18-19) STUDY OF THE DECAY OF ^{147}Pr. 1974.

In Nuclear Physics Laboratory annual report, 1974.

23435 (NP-20507, pp 45-50) HEAVY ISOTOPE OF YTTRIUM. Klein, G. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23436 (NP-20507, pp 50-56) HEAVY ISOTOPES OF MOLYBDENUM. Tittel, G. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23437 (NP-20507, pp 67-72) GAMMA EMISSION AS A COMPETING REACTION WITH NEUTRON EMISSION IN THE DECAY OF 24-s IODINE-137. Nuh, F. M.; Prussin, S. G.; Kratz, K. L.; Franz, H. Jun 1974. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23438 (NP-20507, pp 77-81) DECAY OF TECHNETIUM-103. Siemmerer, K.; Kaffrell, N.; Trautmann, N. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23439 (NP-20507, pp 81-86) DECAY OF 80-s RHODIUM-109. Franz, G. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23440 (NP-20507, pp 86-90) DECAY OF 3.3-s RHODIUM-110. Franz, G. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23441 (NP-20507, pp 90-95) DECAY OF 1.7-MIN PALLADIUM-113 AND 70-s SILVER-113m. Bruechle, W. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23442 (NP-20507, pp 95-99) DECAY OF 2.4-MIN PALLADIUM-114, 5.0-s SILVER-114, AND 12.5-s PALLADIUM-116. Bruechle, W. Jun 1975. (In German).
In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23443 (NP-20508, pp 51-52) LEVEL SCHEME OF ^{105}Ag. Svensson, L. G.; Jonsson, N. G.; Lindskog, J. (Univ. of Uppsala). Jan 1975.
In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23444 (NP-20508, pp 52-54) TRANSITION PROBABILITIES BETWEEN THE $^{9}/_{2}^{+}$ AND $^{7}/_{2}^{+}$ STATES IN ODD-MASS Ag NUCLEI. Svensson, L. G.; Bergman, O.; Jonsson, N. G.; Lindskog, J.; Baecklin, A. (Univ. of Uppsala). Jan 1975.
In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23445 (NP-20508, pp 55-57) POSSIBLE ROTATIONAL STATES IN ODD-MASS In NUCLEI. Dietrich, W.; Baecklin, A.; Lannergard, C. O. (Univ. of Uppsala). Jan 1975.
In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23446 (NP-20508, pp 60-63) MEASUREMENTS OF STATIC ELECTRIC QUADRUPOLE MOMENTS USING THE REORIENTATION PRECESSION TECHNIQUE (REPREC). Thun, J. E.; Hasselgren, L.; Fahlander, C.; Edvardsson, L. (Univ. of Uppsala). Jan 1975.
In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23447 (NP-20508, pp 64-66) GYROMAGNETIC RATIOS OF FIRST 2^{+} STATES IN ^{128,130,132}Xe. Johansson, K. (Univ. of Uppsala); Karlsson, E.; Norlin, L. O.; Arnesen, A.; Noreland, T.; Ogaza, S. Jan 1975.
In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23448 (NP-20508, pp 66-67) B(E2) TRANSITION MOMENTS OF EVEN XENON ISOTOPES. Johansson, K.; Karlsson, E.; Norlin, L. O.; Evardsson, L. O. (Univ. of Uppsala). Jan 1975.
In annual report, 1974. (Tandem Accelerator Laboratoriet, Uppsala (Sweden)).

23449 (UCRL-51846) NUCLEAR DECAY SCHEME STUDIES OF 30-h ^{131}Te/sup m/, 25-MIN ^{131}Te/sup g/, AND 55.5-MIN ^{105}Cd. Jackson, S. V. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. Contract W-7405-Eng-48. 340p. Dep. NTIS $10.60.
Thesis.
High-resolution Ge(Li) detectors have been used to observe gamma-ray singles and coincidence spectra of 30-h $^{11}/_{2}^{-}$, /sup 131m/Te, 25-min $^{3}/_{2}^{+}$, and 55.5-min $^{5}/_{2}^{+}$ ^{105}Cd. Sources of /sup 131m/Te and /sup 131g/Te were produced by neutron irradiation of enriched ^{130}Te metal, and, in the case of /sup 131m/Te, were chemically purified to remove the ^{131}I daughter. A total of 190 and 80 gamma-rays are attributed to the decays of /sup 131m/Te and /sup 131g/Te, respectively; and 174 and 77 of these transitions have been placed in a ^{131}I level scheme involving 52 excited states. Absolute beta group intensities were determined for the transitions to ^{131}I levels. Spin and parity assignments were made for all observed levels. The beta feeding from the $^{11}/_{2}^{-}$ /sup 131m/Te to the $^{7}/_{2}^{+}$ ^{131}I ground state was determined to be (5.2 +- 3.0) percent (log ft equals 10.5). The isomeric transition of $^{11}/_{2}^{-}$ /sup 131m/Te to $^{3}/_{2}^{+}$ /sup 131g/Te was determined to be (22.2 +- 1.6) percent. The 6-nsec isomer in ^{131}I at 1797 keV has been assigned as $^{15}/_{2}^{-}$ and interpreted as a pi nu$_{1}$nu$_{2}$ three quasi-particle state. Sources of ^{105}Cd were produced via the ^{106}Cd(n,2n) reaction on enriched ^{106}CdO using 14 MeV neutrons. A total of 274 gamma-rays are attributed to the decay of ^{105}Cd, and 248 of these have been placed in a ^{105}Ag level scheme involving 50 excited states. Absolute values for the beta^{+}/EC transition intensities to ^{105}Ag levels were determined. The beta^{+}/EC feeding from the $^{5}/_{2}^{+}$ ^{105}Cd to the $^{7}/_{2}^{+}$ 25.5-keV isomeric state in ^{105}Ag was determined to be (51.4 +- 4.0) percent (log ft equals 5.4). Spin and parity assignments were made for all observed levels. The experimentally determined level structures of ^{131}I and ^{105}Cd are interpreted in terms of the shell model and core excitation considerations with emphasis placed on the core coupling model and the three-particle models. (54 figures, 12 tables, 179 references) (auth)

23450 ATLAS OF PHOTONEUTRON CROSS SECTIONS OBTAINED WITH MONOENERGETIC PHOTONS. Berman, B. L. (Univ. of California, Livermore). At. Data Nucl. Data Tables.; 15: No. 4, 319-390(Apr 1975).
Photoneutron cross-section data obtained with monoenergetic photons are presented in a uniform format. This compilation is current as of January, 1975. (auth)

23451 NUCLEAR DATA SHEETS FOR A equals 134. Henry, E. A. (Univ. of California, Livermore). Nucl. Data Sheets.; 15: No. 2, 203-256(Jun 1975).
Nuclear data are compiled for the ten known members of the A equals 134 mass chain. This compilation is based on references received through August 1974. Eight drawings are included which present most of the experimental data, including adopted values. Following the drawings are adopted level-property summaries and listings of experimental data for each member of the A-chain. A discussion of the decay scheme of each nuclide is presented in the Data Sheet section. Substantial detail is provided for the low-lying level structure of ^{134}I, ^{134}Xe, and ^{134}Ba from beta-decay studies and of ^{134}Cs from (n, gamma) studies. Known levels in ^{134}Te rely on systematics for their establishment, while considerable uncertainty still exists in ^{134}Ce levels from beta decay. Two isomers are suggested for ^{134}Sb and ^{134}Pr by their decay properties. (HI,xn gamma) reactions have established five excited levels in ^{134}Nd. Nothing is known about excited levels in ^{134}La, primarily because of the small Q value for ^{134}Ce beta decay. There is a lack of particle-transfer reaction studies throughout this A-chain. (auth)

23452 NUCLEAR DATA SHEETS FOR A equals 137. Bunting, R. L. (Univ. of Colorado, Boulder). Nucl. Data Sheets.; 15: No. 3, 335-369(Jul 1975).
The 1961 version of Nuclear Data Sheets for A equals 137 was revised according to experimental data received before September 1, 1974. Selected experimental data, discussions for J/sup pi/ assignments, and detailed level schemes are presented. Significant additions have been made to all members of the A equals 137 isobar. Areas of continuing experimental activity are the decays of ^{137}I, ^{137}Ce, ^{137}Nd, and ^{137}Pm. The data for ^{136}Ba(n,gamma) and ^{137}I are notably incomplete, and the available ^{137}Nd decay data are not consistent. (auth)

23453 CALCULATION OF THE COLLECTIVE MASS-PARAMETER INCLUDING RPA CORRECTIONS. Pal, M. K.; Zawischa, D.; Speth, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 272: No. 4, 387-395(1975).
6 figs.; 27 refs.
A derivation of the vibrational mass-parameter B is given which makes the consistency with RPA calculations explicit. The expected enhancement by the residual particle-hole and particle-particle interaction is demonstrated by solving the quasiparticle-RPA for deformed nuclei in the rare earth region. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 23399, 23405, 23427, 23432, 23433, 23453, 23460, 23462, 23463, 23478, and 23484.

23454 (COO-2176-40) NEUTRON SPECTROSCOPY. Progress Report: Period Covered, 1 July 1974–30 June 1975. Havens, W. W. Jr.; Melkonian, E.; Felvinci, J. (Columbia Univ., New York (USA). Div. of Nuclear Science and Engineering). 1975. Contract AT(11-1)-2176. 32p. Dep. NTIS $4.75.
Another run at ORELA is scheduled to begin 16 June 1975. Analysis continues on data obtained earlier. The use of contingency tables has been introduced to give quantitative verification of the observed pulse height effects. A new model of the compound nucleus was developed and used to make tentative assignments of J and K quantum numbers to the resonance levels of ^{235}U, including the many new ones observed. The same model has been applied to the calculation of level densities of deformed nuclei resulting in better agreement with observations. The new model was also used to interpret structure in the sequence of s-wave levels in ^{238}U. Calculations continue on the bias introduced in fission cross section measurements using ionization chambers. Additional results are presented on capture cross section measurements on ^{169}Tm and ^{197}Au. A new calculational program has been started with the objective of determining the contribution of neutron scattering by the iron pole pieces of the Nevis synchrocyclotron to the observed backgrounds. (auth)
For titles of individual papers see: 23455 and 23477.

23455 (COO-2176-40, pp 11-14) CAPTURE RESONANCE PARAMETERS OF Tm-169. Arbo, J.; Felvinci, J.; Melkonian, E.; Havens, W. W. Jr. 1975.

In neutron spectroscopy. Progress report: period covered, 1 July 1974–30 June 1975. (Columbia Univ., New York (USA). Div. of Nuclear Science and Engineering).

23456 *(JINR-P6-8781) STUDY OF THE ^{172}Lu DECAY. Avramov, S. R.; Bonch-Osmolovskaya, N. A.; Vylov, Ts.; Gromov, K. Ya.; Khamidov, A. Sh. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Gamma-ray spectra arising at the decay of ^{172}Lu have been studied. The energies, intensities and multipole transitions have been determined. The weak positron ^{172}Lu radiation has been estimated. The ^{172}Yb level scheme has been made more accurate and complete. The ^{172}Yb excited states have been analyzed and identified. (5 tables, 2 figures) (auth)

23457 (NP-20444, pp 34; 37) ANOMALOUS MIXING PARAMETER Z_2 FOR ^{160}Dy. Dasmahapatra, B. K.; Mukherjee, P. 1972. In Saha Institute of Nuclear Physics annual report, 1972.

23458 (NP-20507, pp 102-107) DECAY OF 5.4-MIN THULIUM-174 AND THE MIXING OF $K^{\pi} = 5^-$ TWO-QUASI-PARTICLE STATES IN YTTERBIUM-174. Kaffrell, N.; Kurcewicz, W. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23459 (NP-20508, pp 57-59) TRANSITION PROBABILITIES AND ROTATIONAL BANDS IN THE $^{165-167}$Tm ISOTOPES. Svensson, L. G.; Solhed, H.; Jonsson, N. G.; Lindskog, J. (Univ. of Uppsala). Jan 1975.

In annual report, 1974. (Tandemacceleratorlaboratoriet, Uppsala (Sweden)).

23460 NUCLEAR DATA SHEETS FOR A equals 155. Kroger, L. A.; Reich, C. W. (Aerojet Nuclear Corp., Idaho Falls, ID). Nucl. Data Sheets.; 15: No. 4, 409-496(Aug 1975).

The present work constitutes an updating of the previous A equals 155 data compilation, which appeared in the Nuclear Data Sheets in November 1963. All data available prior to August 1974 were considered for this compilation. Data are given for 10 nuclides, ^{155}Sm(Z equals 62) through ^{155}Lu(Z equals 71). The ground-state spins are now well established for the Z equals 62 through Z equals 67 members of this A-chain. More recent data on atomic masses have resulted in a change in the Q value for the epsilon decay of ^{155}Tb from 1 MeV in the earlier compilation to 817 keV. The bulk of the new data has come from single-nucleon transfer reactions and from semiconductor-detector studies of gamma rays from radioactive decay and charged particle-induced reactions. The results have given a much more complete picture of the energy-level structure of these nuclei. ^{155}Sm, ^{155}Eu, ^{155}Gd, and ^{155}Tb are classified as deformed nuclei since they all exhibit well-developed rotational-band structure. The energy-level systematics of these nuclei are treated in terms of the Nilsson model including various well-established couplings. The N equals 89 nuclide, ^{155}Dy, also exhibits rotational-band structure. However, since it is situated in a mass region where a transition from a deformed to a spherical equilibrium shape is found, the configuration assignments for the observed energy levels are somewhat tentative. Absolute beta$^-$-, gamma(+ce)-, and epsilon(+beta$^+$)-branching ratios are given on the decay-scheme drawings. In all cases these quantities are based on a (gamma+ce) intensity balance normalized to 100 percent decay to the ground state of the daughter nucleus. Specific details concerning the methods used to estimate the beta- or epsilon-branching to the ground state of the daughter nucleus are discussed in connection with the individual nuclides. (auth)

23461 NUCLEAR DATA SHEETS FOR A equals 170. Schmorak, M. R.; Auble, R. L. (Oak Ridge National Lab., TN). Nucl. Data Sheets.; 15: No. 3, 371-407(Jul 1975).

Nuclear structure data from radioactivity and nuclear reaction measurements are summarized, and adopted level properties are presented. The present compilation is based on information available through December 1974. The compilation consists of drawings which display the bulk of the data followed by Summary Sheets which present the adopted level properties in greater detail and, where practical, the data on which they are based. The third section consists of supplementary Data Sheets for those nuclei requiring extensive data tabulations. The ^{170}Lu(epsilon+beta$^+$)^{170}Yb decay scheme is quite complex. Only the lowest portion is reproduced in detail in this compilation. Complete data for the higher levels have been entered in the Evaluated Nuclear Structure Data File (ENSDF) maintained by the Nuclear Data Group, and a complete decay scheme is available upon request. (auth)

23462 NUCLEAR DATA SHEETS FOR A equals 172. Greenwood, L. R. (Northwestern Univ., Evanston, IL). Nucl. Data Sheets.; 15: No. 4, 497-501(Aug 1975).

The 1965 version of the Nuclear Data Sheets was revised according to experimental data received prior to May 1974, including approximately 120 papers. Data are presented for ten nuclei (Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, and Ir). Only alpha decay data are available for Os and Ir, only the half-life is known for Re, and no level scheme is known for Er. The Er(49.3 h) decay scheme is well established and provides the only data available on the Tm level scheme (16 levels, 9 J/sup pi/ values, and 3 proposed rotational bands). The Tm(63.6 h), Lu(6.7 d), and /sup m/Yb(3.6 mu s) decay schemes are compared, and suggested changes and discrepancies in the Yb level scheme are noted. These data as well as considerable reaction data and gamma-multipolarity data establish the Yb level scheme, including 128 levels (45 J/sup pi/ values) and 14 proposed rotational bands. Data on the Lu level scheme are available from Hf(1.87 y) decay and include 10 levels with J/sup pi/ assignments. Two isomers (3.7 m and 440 mu s) and their decays are also known for Lu. The Hf level scheme has been studied by Ta(36.8 m) decay and (xn gamma) reactions and includes 34 levels (17 J/sup pi/ values) with 3 proposed rotational bands. A preliminary decay scheme for W(6.7 m) suggests 4 levels and J/sup pi/ assignments in Ta. (xn gamma) reactions in W have established the ground-state band up to J/sup pi/ equals 14^+. (auth)

23463 NUCLEAR DATA SHEETS FOR A equals 180. Greenwood, L. R. (Northwestern Univ., Evanston, IL). Nucl. Data Sheets.; 15: No. 4, 559-605(Aug 1975).

The 1965 version of the Nuclear Data Sheets was revised according to experimental data received prior to May 1974, including approximately 120 papers. Data are presented for nine nuclei (Lu, Hf, Ta, W, Re, Os, Ir, Pt, and Hg). Only alpha decay data are available for Hg and Pt. No excited states or gamma transitions are definitely assigned to Lu or Ir. A tentative decay scheme for Ir is presented. The decay schemes for Lu(5.7 m), Ta(greater than 10^{13} y and 8.1 h), and Re(2.43 m) are well established. The Os(22 m) decay scheme is still rather uncertain because of a lack of precision gamma-ray energies and intensities. The Hf level scheme includes 46 levels (23 J/sup pi/ values), although only the ground-state rotational band has been established. Branching ratios for ^{179}Hf(n, gamma), /sup 180m/Hf(5.5 h) decay, and ^{180}Lu(5.7 m) decay were compared, and several disagreements are noted. The W level scheme includes 32 levels (16 J/sup pi/ values) with three proposed rotational bands, although several assignments are not well established. The Re level scheme includes 10 levels (3 J/sup pi/ values), all due to Os decay. The Os level scheme includes 10 levels with J/sup pi/values available only for the ground-state band. The most important deficiency in the data is that very few charged-particle reaction data are available except for (d,p) to Hf and (p,t) to W. (auth)

23464 DOUBLE INTERNAL CONVERSION IN ^{150}Sm, ^{179}Hf, AND ^{192}Ir. Prokof'ev, P. T.; Simonova, L. I. (Inst. of Physics, Riga). Yadern. Fiz.; 21: No. 6, 1145-1146(Jun 1975). (In Russian).

A double conversion is found for the transitions 333.94 keV in ^{150}Sm, 160.71 keV in ^{179}Hf and 56.71 keV in ^{192}Ir. (1 table) (auth)

23465 EFFECTIVE MOMENTS OF INERTIA FOR PRE-ACTINIDE NUCLEI. Okolovich, V. N.; Rus'kina, G. Yu. (Inst. of Nuclear Physics, Alma-Ata, USSR). Yadern. Fiz.; 21: No. 6, 1154-1156(Jun 1975). (In Russian).

Results are presented of handling of the measured data on the energy dependence of the angular anisotropy of 23 pre-actinide nuclei from hafnium up to polonium in the α-particle energy range 28–50 MeV. A dependence of the effective moment of inertia J_{eff} on the excitation energy is detected. Phase-transition correlation in J_{eff} (E) and in the energy dependence of the level density parameter for the fission channel is shown. (2 figures) (auth)

23466 FISSION OF PRE-ACTINIDE NUCLEI. Excitation Functions for the (α,f) Reaction. Ignatyuk, A. V.; Itkis, M. G.; Okolovich, V. N.; Smirenkin, G. N.; Tishin, A. S. (Inst. of Nuclear Physics, Alma-Ata, USSR). Yadern. Fiz.; 21: No. 6, 1185-1205(Jun 1975). (In Russian).

At the isochrone cyclotron of Institute of Nuclear Physics AS KazSSR the cross sections are measured for the (α, f) reactions on 29 target nuclei from Hf up to Bi in the α-particle energy range from 25 up to 50 MeV. In framework of the modified Fermi-gas model a description is obtained for the dependence of the ratio of fission width to neutron width on the nucleon contents and on the excitation energy. Analysing the fission width the following characteristics of the strongly deformed transition states of the fissionable nuclei are obtained: the height of the fission barrier, the level density parameter, energy of the phase transition from the superconductive state to the normal state, the correlation function Δ_f. (11 figures, 3 tables) (auth)

23467 DECAY CHAIN ^{162}Yb (19.0 min) yields ^{162}Tm (2.8 min) yields ^{162}Er AND THE DECAY OF ^{160}Tm (9.2 min) TO ^{160}Er. Strusny, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Tyrroff, H.; Herrmann, E.; Musiol, G. Czech. J. Phys.; 25: No. 6, 626-643(1975).

The decay of ^{162}Yb, ^{162}Tm, and ^{160}Tm was investigated with Ge (Li) and Si(Li) detectors using isotopically separated samples produced by the UASNAPP facility at Dubna. The singles gamma-ray spectrum, beta-gamma and gamma-gamma coincidences were measured. Strong ytterbium and thulium activities were used for conversion electron measurements with high resolution magnetic beta-spectrographs. There were 3, 134 and 39 new gamma-rays attributed to the decays of ^{162}Yb, ^{162}Tm and ^{160}Tm, respectively. Decay schemes of these isotopes are proposed. Three and 12 new levels were found in ^{162}Er and ^{160}Er, respectively. The Q-values of ^{162}Yb, ^{162}Tm and ^{160}Tm were determined to be greater than or equal to 2.2 MeV, 4.6 +- 0.3 MeV and 4.0 +- 0.5 MeV, respectively. (auth)

23468 LOW-SPIN STATES IN ^{151}Gd. Hammaren, E.; Puhakka, P.; Siivola, A.; Tuurnala, T. (Helsinki Univ. (Finland). Dept. of Physics). Z. Phys., A; 272: No. 4, 341-349(1975).

7 figs.; 1 tab.; 23 refs.

The level structure of the 87-neutron nucleus ^{151}Gd has been investigated by studying the EC- and β^+-decay of ^{151}Tb. Gamma-ray and conversion electron spectra as well as gamma-gamma coincidence spectra were measured by using semiconductor spectrometers and a high-capacity two-parameter recording system. The proposed decay scheme contains several new energy levels in ^{151}Gd, among them a $5/2^-$ state at 427 keV. To explain the low-energy level structure, a small stable deformation is assumed for ^{151}Gd. Using a single-particle-plus-rotor model based on a generalized Woods-Saxon potential, complete mixing of the shells $1h_{9/2}$, $2f_{7/2}$ and separately $1i_{13/2}$ is observed. By these mixings the correct level order and approximately correct excitation energies up to 1 MeV are reproduced. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 22059, 23327, 23387, 23404, 23405, 23427, 23432, 23433, 23464–23466, 23478, 23484, and 23499.

23469 (COO-3496-50, pp 36-46) STUDY OF STRONGLY DAMPED COLLISIONS. Birkelund, J. R. (Univ. Marburg, West Germany); Huizenga, J. R.; Freiesleben, H.; Wolf, K. L.; Unik, J. P.; Viola, V. E. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23470 (COO-3496-50, pp 58-68) ELASTIC SCATTERING OF ^{40}Ar AND ^{84}Kr ON ^{209}Bi AND ^{238}U. Birkelund, J. R. (Univ. Marburg, West Germany); Huizenga, J. R.; Freiesleben, H.; Wolf, K. L.; Unik, J. P.; Viola, V. E. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23471 (NP-20444, pp 34-35; 37) B(E2) RATIOS IN THE TRANSITION NUCLEI ^{192}Pt AND ^{192}Os. Dasmahapatra, B. K.; Mukherjee, P. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23472 DETERMINATION OF SPIN, MAGNETIC MOMENT AND ISOTOPIC SHIFT OF NEUTRON RICH ^{205}Hg BY OPTICAL PUMPING. Rodriguez, J.; Bonn, J.; Huber, G.; Kluge, H. J.; Otten, E. W. (Heidelberg Univ. (F. R. Germany). 1. Physikalisches Inst.; European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration). Z. Phys., A; 272: No. 4, 369-374(1975).

Neutron rich ^{205}Hg($T_{1/2}$ = 5.2 min) was produced and on-line mass separated at the ISOLDE facility at CERN. The polarization achieved by optical pumping via the atomic line ($6s^2{}^1S_0 - 6s6p^3P_1$, λ = 2,537 Å) was monitored by the β decay asymmetry. Hyperfine structure and isotopic shift of the ^{205}Hg absorption line was determined by Zeeman scanning. In addition a magnetic resonance was performed on the polarized ^{205}Hg nuclei in the atomic ground state. The results are: $I(^{205}Hg) = 1/2$ (confirmed); $\mu(I,^{205}Hg) = 0.5915(1)\mu(N)$ (uncorrected for diamagnetism); isotopic shift $\delta\nu$ (204/205) = $\nu(^{205}Hg) - \nu(^{204}Hg) = -1.8(1)$GHz. μ(I) and IS are discussed briefly in the frame of current literature. (auth)

23473 ORIENTATION OF ^{199}Hg(IT) BY OPTICAL PUMPING DETECTED BY γ-RADIATION ANISOTROPY. Bonn, J.; Huber, G.; Kluge, H. J.; Otten, E. W. (Heidelberg Univ. (F. R. Germany). 1. Physikalisches Inst.); Lode, D. (Technische Univ. Braunschweig (F. R. Germany); European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration). Z. Phys., A; 272: No. 4, 375-380(1975).

^{199}Hg(IT) was produced and mass separated at the ISOLDE facility (CERN). Nuclear orientation achieved by optical pumping via the resonance line $6s^2{}^1S_0 \rightarrow 6s6p^3P_1$, λ = 2,537 Å was monitored by means of the anisotropy of the γ-radiation emitted in the cascade ^{199}Hg(IT,$I = 13/2^+$) M4 transition → ^{199}*Hg($I = 5/2^-$) E2 transition → ^{199}Hg($I = 1/2^-$). Maximum anisotropies of 35% (2.8%) were found in the M4(E2) transition. A Zeeman scanning of the $^3P_1$ state yielded the positions of $F = 13/2$ and the $F = 11/2$ hfs components relative to the reference isotope ^{204}Hg at 15.13(15) GHz and −2.86(15) GHz, respectively. The isotopic shift and the quadrupole interaction constant were deduced from these values using the known A factor. $\Delta\nu$(199 m/204) = ν(204) − ν(199m) = − 12.20(16) GHz. B = −0.86 (25)GHz. From the B factor the spectroscopic quadrupole moment was calculated as Q = 1.54(44) barn. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 22056, 23427, 23450, 23454, and 23470.

23474 (BNWL-B-281) FINAL REPORT ON ARPA FISSION YIELD PROJECT WORK AT BATTELLE-NORTHWEST, APRIL 1970--APRIL 1973. Ballou, N. E.; Kaye, J. H.; Reeder, P. L.; Stoffels, J. J.; Anderl, R. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1973. Contract AT(45-1)-1830. 75p. Dep. NTIS $6.75.

The overall objective has been to measure the independent and cumulative fission yields of selected halogen and rare gas nuclides for application to characterization of underground nuclear detonations. The studies have included fission yield measurements for thermal, fission spectrum, and 15 MeV neutron-induced fission events. Target materials included ^{235}U, ^{238}U and ^{239}Pu. The research effort was divided into two basic parts. In one part, the nuclides of interest were separated radiochemically and determined by gamma-ray spectrometry. This approach provides information on the independent and cumulative yields of nuclides with half-lives of a few seconds or greater. The second part of our effort involved the use of on-line mass separation techniques. This approach yields information on independent fission yields of nuclides with half-lives ranging down to fractions of a second and provides data on all significant isotopes of a given fission product element in one set of measurements. The main effort in the radiochemistry program was centered on measurements of the cumulative fission yield of ^{89}Kr. Cumulative fission yields of ^{89}Kr were measured for thermal-neutron fission of ^{239}Pu and for fission-spectrum and 15-MeV neutron fission of ^{235}U, ^{238}U and ^{239}Pu. In addition, cumulative fission yields of the other rare gas radionuclides, /sup 85m/Kr, ^{87}Kr, ^{88}Kr, ^{137}Xe, ^{138}Xe, were measured for the same fission type events. Fractional independent yields of ^{89}Rb and ^{138}Cs were also measured for a limited number of fission systems. On-line mass spectrometer facilities were established at a Van de Graaff accelerator and at a nuclear reactor. Measurements were made of relative independent fission yields of rubidium isotopes of masses 89 through 97 and of cesium isotopes of masses 139 through 145. Techniques for generation and measurement of negative ions of bromine and iodine fission product isotopes were developed and demonstrated. (23 tables, 6 figures) (auth)

23475 (CONF-750427-6) ^{238}U(n,f) MEASUREMENTS BELOW 30 keV. Slovacek, R. E.; Cramer, D. S.; Bean, E. B.; Hockenbury, R. W.; Valentine, J. R.; Block, R. C. (Knolls Atomic Power Lab., Schenectady, N.Y. (USA); Rensselaer Polytechnic Inst., Troy, N.Y. (USA)). 1975. 16p. Dep. NTIS $4.00.

From meeting of the American Physical Society; Washington, District of Columbia, USA (28 Apr 1974).

The ^{238}U (n,f) cross section has been measured from 3 eV to about 30 keV with the lead slowing down spectrometer at the RPI Linac. Four fission ionization chambers containing a total of about 0.8 gm of ^{238}U (4.1 ppm ^{235}U) were used for the measurements. The fission widths of the 6.67, 20.9, and the 36.8 eV resonances were measured as (10 +- 1), (58 +- 9), and (12 +- 2) nanoelectronvolts respectively. The fission cross section integrated over the two subthreshold groups at 720 and 1210 eV and the average fission cross section from 10 to 30 keV are in agreement with a previous time of flight measurement. The fission width at 6.67 eV is 20 times smaller than an upper limit set by the only reported measurement in this energy region; the fission widths obtained in the present investigation are consistent with the (30 +- 50) nanoelectronvolt average width previously obtained for the resonances

between 37 and 327 eV in a time of flight measurement using a nuclear device. From the measured fission widths, the ^{238}U thermal fission cross section was determined to be 2.7 +- 0.3 mu barns. The resonance fission integral was also obtained from the data as 1.33 +- 0.15 mbarns for ^{238}U. (4 figures, 4 tables) (auth)

23476 (COO-2176-26) PULSE HEIGHT EFFECTS IN THE MEASUREMENT OF U-233 FISSION CROSS SECTIONS. Felvinci, J. P.; Melkonian, E. (Columbia Univ., New York (USA). Div. of Nuclear Science and Engineering). 1974. 4p. (CONF-741017-37). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Partial fission cross sections were calculated for different energy cuts in the fission fragment distribution. Statistically significant differences exist between different cuts. Some levels previously assumed to be single were split into two or more structures. It was concluded that fission cross sections are sensitive to pulse height bias and that level parameters calculated from biased measurements (when not all fragments are detected) may be in error. (2 figures) (RWR)

23477 (COO-2176-40, pp 5-11)) DETERMINATION OF FISSION FRAGMENT ENERGY SPECTRUM DISTORTION IN FISSION CROSS SECTION MEASUREMENTS USING IONIZATION CHAMBERS. Cohensedgh, F.; Felvinci, J. P.; Melkonian, E. 1975.

In neutron spectroscopy. Progress report: period covered, 1 July 1974–30 June 1975. (Columbia Univ., New York (USA). Div. of Nuclear Science and Engineering).

23478 (COO-3496-50) STUDIES OF NUCLEAR FISSION, LOW ENERGY NUCLEAR REACTIONS AND TRANSURANIC NUCLEI. Progress Report 1 June, 1974–1 June, 1975. Huizenga, J. R. (Rochester Univ., N. Y. (USA)). 1975. 106p. Dep. NTIS $8.50.

The research program included (1) direct reaction studies on heavy targets, (2) very heavy-ion induced reactions, (3) muonic atom lifetime measurements in actinide elements, (4) the study of the effect of pressure on electron capture decay rates and (5) angular momentum dependent level density calculations. The direct reaction studies have characterized single-neutron and proton Nilsson states and collective states in actinide nuclei as well two-neutron transfer reactions in osmium isotopes. The study of Kr induced reactions has shown that the major fraction of the total reaction cross section is accounted for by strongly damped collision processes. These collisions are characterized by (1) nucleon transfer yielding fragments with masses in the vicinity of the target and projectile masses (although if the target mass is large enough the excited heavy fragment will sequentially fission), (2) strong damping of the energy of relative motion of the fragments resulting in final fragment kinetic energies which correspond to Coulomb energies for charge centers of highly deformed fragments, and (3) angular distributions which have features characteristic of a direct reaction. Elastic scattering of ^{40}Ar and ^{84}Kr on heavy targets have been measured in order to deduce total reaction cross sections. Preliminary measurements of the mu-mesic atom lifetimes of ^{232}Th and ^{238}U were made by use of the technique of detecting muon-decay electrons. Experiments to detect the effect of pressure on the electron capture decay lifetime of ^{22}Na were initiated. (auth)

For abstracts of individual papers see: 23248, 23397, 23412, 23469, 23470, and 23479–23484.

23479 (COO-3496-50, pp 11-16) COLLECTIVE STATES POPULATED BY INELASTIC DEUTERON SCATTERING ON EVEN-EVEN ACTINIDE NUCLEI. Thompson, R. C. (Univ. Frankfurt am Main); Huizenga, J. R.; Elze, Th. W.; Unik, J. P. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23480 (COO-3496-50, pp 17-24) INELASTIC DEUTERON SCATTERING FROM ODD-A ACTINIDE NUCLEI. Thompson, R. C. (Univ. Frankfurt am Main); Huizenga, J. R.; Elze, Th. W.; Unik, J. P. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23481 (COO-3496-50, pp 25-27) STUDY OF THE $^{234}U(d,t)^{233}U$ REACTION. Johnson, W.; Thompson, R. C.; Huizenga, J. R. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23482 (COO-3496-50, pp 28-29) STUDY OF THE LEVELS IN ^{236}Np AND ^{238}Np BY THE $^{237}Np(d,t)$ AND $^{237}Np(d,p)$ REACTIONS. Thompson, R. C.; Huizenga, J. R. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23483 (COO-3496-50, pp 30-34) NUCLEAR LEVELS OF ^{239}Np EXCITED BY THE (^{3}He,d) AND (alpha,t) REACTIONS. von Egidy, T. (Tech. Univ. Munich); Elze, Th. W.; Huizenga, J. R. 1975.

In studies of nuclear fission, low-energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23484 (COO-3496-50, pp 69-80) HEAVY ION TOTAL REACTION CROSS SECTION SYSTEMATICS DETERMINED FROM ELASTIC SCATTERING. Birkelund, J. R. (Univ. Marburg, West Germany) Huizenga, J. R.; Freiesleben, H.; Wolf, K. L.; Unik, J. P.; Viola, V. E. 1975.

In studies of nuclear fission, low energy nuclear reactions and transuranic nuclei. Progress report 1 June 1974–1 June 1975. (Rochester Univ., N. Y. (USA)).

23485 (LBL-3887) SHAPE ISOMER EXCITABION BY MU-MINUS CAPTURE. Kaplan, S. N.; Monard, J. A.; Nagamiya, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. 14p. (CONF-750631-10). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

In a search for back-decay gamma rays from the shape isomer in ^{238}U following mu-minus capture, no candidates have been found with yields greater than 2 percent of the muon stoppings. The intensities of the gamma rays are insufficient to permit definitive lifetime measurements of individual peaks; however, for 500-keV energy ranges of gamma ray pulses, lifetimes have been determined that give results consistent with recent electron lifetime measurements. (6 figures, 2 tables) (auth)

23486 (NP-20444, pp 124; 130-131) SUPERHEAVY NUCLEI. Ghosh, S. K.; Chatterjee, A. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23487 (NP-20444, pp 133-134) FISSION NEUTRONS. Sarkar, R.; Chatterjee, A. 1972.

In Saha Institute of Nuclear Physics annual report, 1972.

23488 (NP-20482) NUCLEAR PHYSICS LABORATORY ANNUAL REPORT, 1974. (Ghent Rijksuniversiteit (Belgium)). 1974. 40p. Dep. NTIS (US Sales Only) $5.00.

In 1974, the work at the linear accelerator of the nuclear physics laboratory at the State University of Ghent was concentrated in the following areas: (1) nuclear fission experiments, (2) photonuclear reaction studies, (3) nuclear spectroscopy and positron annihilation studies, (4) dosimetry, and (5) theoretical studies relating to experimental programs. The most important results are summarized and a list of publications is appended. (SDF)

For titles of individual papers see: 23383, 23434, 23489, and 23490.

23489 (NP-20482, pp 5-7) STUDY OF THE MASS DISTRIBUTION FOR THE PHOTOFISSION OF ^{238}U WITH 25-MeV END POINT BREMSSTRAHLUNG, FOR THE SPONTANEOUS FISSION OF ^{252}Cf, AND FOR THE FISSION OF ^{235}U BOMBARDED WITH THERMAL NEUTRONS. 1974.

In Nuclear Physics Laboratory annual report, 1974.

23490 (NP-20482, pp 8-10) STUDY OF THE MASS AND KINETIC ENERGY DISTRIBUTION OF THE FRAGMENTS FOR THE PHOTOFISSION OF ^{235}U AND ^{238}U WITH 25 MeV ENDPOINT BREMSSTRAHLUNG. 1974.

In Nuclear Physics Laboratory annual report, 1974.

23491 (NP-20507, pp 73-76) NEUTRON EMISSION PROBABILITY AND CUMULATIVE FISSION YIELD OF ANTIMONY-134, -135, AND -136. Rudolph, W.; Kratz, K. L.; Ohm, H. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23492 (NP-20507, pp 108-111) CHARGE DISTRIBUTION IN THE A = 99 CHAIN UPON FISSION OF URANIUM-235 BY THERMAL NEUTRONS. Weis, M. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23493 (NP-20507, pp 112-118) MASS YIELDS IN THE REACTION OF KRYPTON-84 WITH URANIUM-238. Kratz, J. V.; Norris, A. E.; Seaborg, G. T. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23494 (NP-20508, pp 68-70) MEASUREMENTS OF FISSION CROSS-SECTION RATIOS AND FISSION-FRAGMENT ANGULAR DISTRIBUTIONS. Conde, H. (Research Inst. of National Defence, Stockholm); Stroemberg, L. G.; Nordborg, C. Jan 1975.
In annual report, 1974. (Tandemacceleratorlaboratoriet, Uppsala (Sweden)).

23495 (UCRL-76548) EXCITED QUASIPARTICLE STATES OF ODD-MASS DEFORMED NUCLEI IN THE TRANSPLUTONIUM ELEMENTS. Hoff, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Aug 1975. 22p. (CONF-750915-8). Dep. NTIS $4.25.
From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).
Experimental evidence is summarized from the published literature for excited single-particle configurations in the actinide-element deformed nuclei. Experimental data is compared for the levels of ^{249}Bk and ^{245}Cm with two recent theoretical treatments, one calculation of pure single-particle levels and another in which interactions between single-particle and collective motions are included. In the latter half of the paper, new information is presented on ^{249}Bk levels from nuclear spectroscopic measurements of ^{253}Es alpha decay and ^{249}Cm beta decay performed at Lawrence Livermore Laboratory and Lawrence Berkeley Laboratory. (5 figures) (auth)

23496 DETERMINATION OF ^{243}Am HALF-LIFE. Polyukhov, V. G.; Timofeev, G. A.; Privalova, P. A.; Gabeskiriya, V. Ya.; Chetverikov, A. P. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1103-1105(Oct 1974).
Translated from At. Energ. (USSR); 37: No. 4, 357-359(Oct 1974).
The alpha decay half-life of ^{243}Am has been determined using isotopes of two different compositions. Results are compared with previous measurements. (1 figure, 4 tables) (SDF)

23497 EXPERIMENTS ON THE SYNTHESIS OF NEUTRON-DEFICIENT KURCHATOVIUM ISOTOPES IN REACTIONS INDUCED BY ^{50}Ti IONS. Oganesyan, Yu. Ts.; Demin, A. G.; Il'inov, A. S.; Tret'yakova, S. P.; Pleve, A. A.; Penionzhkevich, Yu. E.; Ivanov, M. P.; Tret'yakov, Yu. P. At. Energ. (USSR); 38: No. 6, 382-390(Jun 1975). (In Russian).
Two new isotopes of element 104 (kurchatovium) with mass numbers 255 and 256 were synthesized by bombarding Pb isotopes with ^{50}Ti ions. The isotope ^{256}Ku is formed in the reaction ^{208}Pb (^{50}Ti, 2n) and has a spontaneous fission half-life of about 5 ms. The odd isotope ^{255}Ku is formed with a maximum cross section in the reaction ^{207}Pb (^{50}Ti, 2n) and has a half-life of several seconds. The experimental results obtained, together with the available data on the properties of kurchatovium, substantially change the understanding of the stability of heavy nuclei with respect to spontaneous fission. In this connection, the influence of the fission barrier structure on the properties of heavy nuclei is discussed. On the basis of the experimental data on the synthesis of Fm and Ku neutron-deficient isotopes in reactions induced by ions heavier than argon, the possibilities of synthesizing elements with $Z \geq 106$ are investigated. (9 figures, 1 table) (auth)

23498 MASS DISTRIBUTION OF ^{252}Cf FISSION FRAGMENTS. Lisin, S. K.; Morozov, L. N.; Novgorodtseva, V. I.; Pchelin, V. A.; Chistyakov, L. V.; Shigin, V. A.; Shubko, V. M. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 6, 1178-1184(Jun 1975). (In Russian).
The radiochemical method is used to measure the mass distributions of ^{252}Cf fission fragments at various excitation energies. The nucleus ^{252}Cf was produced via bombarding the ^{248}Cm nuclei by α particles; at the α-particle energies of 24, 29 and 34 MeV the ^{252}Cf fission keeps being asymmetrical. The widths of the mass peaks at the half-height are 22, 25 and 28 mass units; the peak-to-dip rations are, respectively, 3.5, 2.0 and 1.7. Variation of the ^{252}Cf mass distribution when the energy increases is not consistent with predictions of the statistical model. (2 tables, 2 figures) (auth)

23499 APPROXIMATE ATOMIC WEIGHTS OF UNSTABLE AND SUPERHEAVY ELEMENTS. Bhattacharjee, B. J. (St. Anthony's Coll., Meghalaya, India). Indian J. Theor. Phys.; 22: No. 2, 69-70(Jun 1974).
A statistical relation which can approximately calculate the atomic weights of unstable and superheavy elements is proposed. The results of a curve-fitting study indicated use of a third-order equation, $A = 0.2745 + 1.8965Z + 0.0119Z^2 - 0.000054Z^3$. On the basis of this equation, atomic weights are calculated for elements with Z from 80 to 115. (1 table) (RWR)

Nuclear Theory

Refer also to abstracts 23299, 23387, 23389, and 23484.

23500 (CONF-750663-2) IS THERE A UNIVERSAL RELATIONSHIP CONNECTING ALL TWO-BODY EFFECTIVE INTERACTIONS. Schiffer, J. P. (Argonne National Lab., Ill. (USA); Chicago Univ., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 23p. Dep. NTIS $4.25.
From international solvent extraction conference; The Hague, Netherlands (19 Apr 1971).
It is shown that it is possible to fit the two-body matrix element data from A equals 8 to 208 with a single interaction. Calculated and observed matrix elements are given. (12 figures, 4 tables) (SDF)

23501 (COO-2171-47) ASPECTS OF STATISTICAL SPECTROSCOPY RELEVANT TO EFFECTIVE-INTERACTION THEORY. French, J. B. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 1975. 14p. (CONF-750663-4; UR-534). Dep. NTIS $4.00.
From international topical conference on effective interactions and operators in nuclei; Tucson, Arizona, USA (2 Jun 1975).
The three aspects of statistical spectroscopy discussed in this paper are the information content of complex spectra: procedures for spectroscopy in huge model spaces, useful in effective-interaction theory; and practical ways of identifying and calculating measurable parameters of the effective Hamiltonian and other operators, and of comparing different effective Hamiltonians. (4 figures) (RWR)

23502 (IFA-NR-56-1975) RESONANT ABSORPTION OF GAMMA RAYS IN THE PRESENCE OF HIGH INTENSITY PHOTON FIELDS. Petrascu, M. (Comitetul de Stat pentru Energia Nucleara, Bucharest (Romania)). 1975. 6p. Dep. NTIS (US Sales Only) $4.00.
The possibility of compensating the recoil energy loss of gamma rays is discussed on the basis of a two-photon absorption process. Absorption cross sections as high as 10^{-23} cm^2, many orders of magnitude larger than Thomson and Rayleigh cross sections, are estimated in taking into account the presently available pulse dye lasers. This suggested effect can have an application in investigating phonon spectra in crystals or liquid structure. (auth)

23503 (JINR-P4-8751) NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS FOR INTEGRO-DIFFERENTIAL EQUATIONS IN NUCLEAR THEORY. Gareev, F. A.; Goncharov, S. A.; Zhidkov, E. P.; Pusynin, I. V., Khoromskii, B. N.; Yamaleev, R. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 27p. (In Russian). Dep. NTIS (US Sales Only) $4.50.
A method is presented for numerical solution of eigenvalue problems for a system of integro-differential equations. A suggested modification of the continuous analog of the Newton method reduces the solution of this problem to the solution of a sequence of boundary value problems for a system of nonlinear differential equations. (1 figure, 2 tables) (auth)

23504 (JINR-P4-8889) MAGNETIC MOMENTS OF EXCITED STATES IN DEFORMED NUCLEI. Bunatyan, G. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.
In the thermodynamic approach to the description of nuclear highly excited states, an expression is obtained for the magnetic moment mean value in highly excited states of strongly deformed nuclei with spin I and temperature T, corresponding to the neutron binding energy. Thermodynamically averaged Green's functions are used for this consideration. In the quasi-classical approximation the mean value of the gyromagnetic ratio is calculated, and the possible different deflections from this mean value are discussed. The results of calculations are compared with the experimental data. (auth)

23505 (JINR-P4-8900) PROGRAM FOR CALCULATIONS OF THE COLLECTIVE PARAMETERS AND ENERGIES OF THE DEFORMED EVEN–EVEN NUCLEI IN THE NONADIABATIC CASE. Karadzhov, D.; Piperova, I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 63p. (In Russian). Dep. NTIS (US Sales Only) $6.25.
This program allows the calculation of the collective parameters for even–even deformed nuclei in the adiabatic approximation, as well as the nonadiabatic corrections to these parameters due to rotation. (auth)

23506 (LA-UR-75-1305) PERTURBATION THEORY OF EFFECTIVE HAMILTONIANS. Brandow, B. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 22p. (CONF-750663-3). Dep. NTIS $4.25.

From international topical conference on effective interactions and operators in nuclei; Tucson, Arizona, USA (2 Jun 1975).

This paper constitutes a review of the many papers which have used perturbation theory to derive "effective" or "model" Hamiltonians. It begins with a brief review of nondegenerate and non-many-body perturbation theory, and then considers the degenerate but non-many-body problem in some detail. It turns out that the degenerate perturbation problem is not uniquely defined, but there are some practical criteria for choosing among the various possibilities. Finally, the literature dealing with the linked-cluster aspects of open-shell many-body systems is reviewed. (RWR)

23507 (ORO-4856-19) NONRELATIVISTIC HARD-PION PRODUCTION AND CURRENT-FIELD ALGEBRA. II. Reactions with Composite Targets. Technical Report No. 76-006. Banerjee, M. K.; Levinson, C. A.; Shuster, M. D.; Zollman, D. A. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jul 1975. 21p. Dep. NTIS $4.25.

Current-field algebra and mass dispersion relations are applied to the study of pion production in nucleon–nucleus collisions. The pion-production cross sections when only the pion is observed are shown to depend at threshold only on the target-projectile optical potential. The nature of the "hard"-pion corrections are examined in a nonrelativistic framework. (auth)

23508 CONSIDERATION OF PAIR CORRELATIONS IN ATOMIC NUCLEI PROVIDED THAT PARTICLE NUMBER IS EXACTLY CONSERVED. Sysoeva, S. A.; Tsekhmistrenko, Yu. V. (Kiev State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 1, 25-29(Jan 1975). (In Russian).

Wave function of ground and excited non-collective states are calculated with taking into account the superconductor pair correlations and conservation of the exact particle number. An expression for the gap in the non-collective two quasi-particle excitation spectrum of even-even nuclei and correlation function are found. (6 figures) (auth)

23509 EXACT EXPRESSION FOR THE PROJECTED ENERGY. Warke, C. S. (Tata Inst. of Fundamental Research, Bombay). Pramana.; 5: No. 1, 33-36(Jul 1975).

The angle-integrated exact expression for the projected energy is derived from two different expansions of the rotation operator. In one the spin matrix polynomial expansion method is used, while in the other the disentangling theorem for angular momentum operator is used. (auth)

23510 NON-ADIABATIC TREATMENT OF FISSION MASS DISTRIBUTION. Lichtner, P.; Drechsel, D. (Mainz Univ. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 272: No. 4, 403-411(1975).

3 figs.; 14 refs.

The influence of dynamical corrections to fission mass yields has been studied within the frame work of the macroscopic-microscopic approach and solving the time-dependent Schroedinger equation for the asymmetry degree of freedom, treating the fragment separation classically. The results indicate that the actual motion lies in between the adiabatic and sudden approximations. In particular the dynamic effects tend to increase considerably the probability for symmetric fission as compared to the static case. (auth)

23511 TESTS OF THE SPIN-DEPENDENT STATISTICAL MODEL FOR COMPOUND NUCLEAR REACTION. Pacer, J. C. Lafayette, IN; Purdue Univ. (1974). 146p. University Microfilms Order No. 75-10,935.

Thesis (Ph. D.).

The validity of the spin-dependent statistical model for describing compound nuclear reactions has been tested. The independence hypothesis has been tested by the comparison of the alpha and np exit channels of the compound nuclei ^{49}V, ^{52}Cr, ^{55}Mn, ^{56}Fe, ^{60}Ni, ^{62}Cu, ^{64}Zn, and ^{68}Ga. These compound nuclei were formed by the bombardment of the appropriate targets with 14.0 MeV protons and with alpha-particles corresponding to the same excitation energy of the compound nucleus. The ^{68}Ga compound nucleus was also formed by 12.0 and 16.0 MeV protons and the corresponding alpha-particles. In all cases except one, the ^{52}Cr compound nucleus, the independence hypothesis was verified within the uncertainty of the experimental data and the spin-dependent statistical calculations. The levels of the residual nuclei ^{63}Cu and ^{65}Cu have been studied by the (p,p'), (p,alpha), (alpha,p), and (alpha,alpha') reactions induced by 12.5-16.0 MeV protons and 16.8-21.3 MeV alpha-particles. The levels of ^{63}Cu were populated by one set of bombarding energies whereas, the ^{65}Cu levels were populated by three sets of bombarding energies. The decay by proton and alpha-particle emission of the compound nucleus ^{68}Ga at excitation energies of 17.4, 18.4, 20.4, and 22.4 MeV has been compared with the spin-dependent statistical model. The experimental spectra possessed an energy dependence which the statistical theory could not reproduce, except by allowing a or delta for the residual nucleus corresponding to the spectra of interest to vary with energy. (auth)

PHYSICS (RADIATION AND SHIELDING)

Refer also to abstract 22794.

Radiation Physics

Refer also to abstracts 22303, 22311, 22358, 22484, 22562, 22563, and 23284.

23512 (AD/A-001765) NONEQUILIBRIUM CONDUCTIVITY OF AIR INDUCED BY IONIZING RADIATION. Final Report. Johnston, R. R. (Science Applications, Inc., Palo Alto, Calif. (USA)). 30 Nov 1974. Contract N00014-74-C-0360. 36p. (SAI-072-626-PA). NTIS $3.75.

Computer results for the time-dependent non-equilibrium conductivity of air subjected to an intense dose of ionizing radiation in the presence of a strong electric field are presented. A two-temperature model is employed throughout, and an appropriate set of reaction equations for the time-dependent specie concentrations are solved. Results are presented for the conductivity, the electron concentration, and the electron and gas temperatures for several cases of interest. (GRA)

23513 (COO-323-33) COMPOSITION VARIABILITY AND EQUIVALENCE OF SHONKA TE PLASTIC. Spokas, J. J. (Illinois Benedictine Coll., Lisle (USA). Physical Sciences Lab.). 1973. 17p. (CONF-750546-2). Dep. NTIS $4.00.

From annual meeting of the Radiation Research Society; Miami, Florida, USA (12 May 1975).

A number of conducting plastic mixtures had been developed by Francis R. Shonka, and collaborators, in the Physical Sciences Laboratory of Illinois Benedictine College (formerly St. Procopius College). Several of these mixtures have been used widely in radiation research. In particular, a tissue-equivalent (muscle) formulation designated A-150 has been used extensively in the dosimetry, research and measurements of gamma, neutron and pion beams. Certain confusion has arisen concerning the composition of A-150. The definition of A-150 is reviewed and what is known of the composition is summarized. The equivalence of A-150 and ICRU "muscle" with respect to photons is discussed as a function of photon energy using the latest data on extranuclear photon cross sections. (auth)

23514 (SC-RR-69-654) THEORETICAL DOSIMETRY OF $^{238}PuO_2$-ZrO_2 AND $^{238}PuO_2$-ThO_2 SOLID SOLUTION FUELS. Parsont, M. A.; Holley, W. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Apr 1970. 22p. Dep. NTIS $4.25.

Theoretical computations show that the 17 KeV x-ray, alpha particle, and neutron doses from $^{238}PuO_2$-ThO_2 and $^{238}PuO_2$-ZrO_2 solid solution fuels are generally proportional to the amount of PuO_2 in the fuels. (auth)

23515 (UCID-16777) X-RAY DETERMINATION OF CHARGE STATES OF IONS MOVING IN SOLIDS. Fortner, R.J.; Matthews, D. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Feb 1974. Contract W-7405-ENG-48. 56p. Dep. NTIS $6.00.

The first part of this work discusses previous measurements of x-ray spectra and thick-target yields for Ar ions moving in solid graphite targets. These data are strongly affected by "solid target effects." There are some rather serious limitations in the above measurements. This proposal solicits funds to expand the program to eliminate the limitations. The second part of the proposal contains a more detailed presentation of three types of measurements. These involve the extension of work to other collision systems, the development of an Auger electron spectrometer, and the use of a 7-m grazing-incidence spectrograph for x-ray spectroscopy. These measurements will enable testing of current pictures describing ions moving in solids and shed light on the feasibility of producing a beam of ions which could give rise to amplified stimulated x-ray emission (x-ray laser). (11 figures) (RWR)

23516 EFFECT OF ENERGY DEGRADATION ON THE ENERGY SPECTRUM OF FAST ELECTRONS IN MATTER. Remizovich, V. S. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1085-1087(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 346-347(Oct 1974).

In passing through matter fast electrons lose energy as a result of collisions with atomic electrons. Previous treatments of this problem made some undesirable assumptions; therefore, the situation with regard to energy lost, depth of penetration, and expression for the distribution function is re-examined. Distribution functions are obtained for relativistic and nonrelativistic cases. (RWR)

23517 TARGET-THICKNESS-ANGULAR-SPREAD TABLES FOR PROTON AND PION BEAMS. Hungerford, E. V.; Mayes, B. W. (Univ. of Houston, TX). At. Data Nucl. Data Tables.; 15: No. 5, 477-512(May 1975).

When passing through materials, a parallel beam of charged particles is given an angular divergence by multiple Coulomb scattering processes. Convenient measures of the spreading of the scattered beam are given by the standard-deviation angle, the full-width-half-maximum angle, and the full-width-tenth-maximum angle. These tables present the thicknesses of materials that produce these three angular spreadings in the range 5 to 60 mrad. Values are given for protons with energies between 200 and 850 MeV and for pions with energies between 50 and 700 MeV. Steps of 50 MeV are employed in both cases. The target materials are He, C, Al, Ar, Ca, Fe, Zn, Ge, Kr, Zr, Ag, Cs, Hf, Au, and Pb. The tabulated values were computed from Moliere theory with constants chosen to fit experimental data. Suggestions for interpolation in Z, A, particle energy, and angle are given. (7 figures, 2 tables) (auth)

23518 PARAMETRIC REPRESENTATIONS OF THE ENERGY DEPOSITION BY FAST ELECTRONS UNDER OBLIQUE INCIDENCE. Tabata, T.; Ito, R. (Osaka Prefectural Univ., Sakai, Japan). Int. J. Radiat. Phys. Chem.; 26: No. 6-7, 411-415(Jun 1975).

Application of a series of weighted Laguerre polynomials has been investigated to reproduce energy deposition distributions of fast electrons obliquely incident on the plane surface of a semi-infinite absorber. Details of the representation have been determined by fitting the series to the distributions generated by the Monte Carlo code of Berger and Seltzer (Tables of Energy Losses and Ranges of Electrons and Positrons, NASA SP-3012 (1964)). Polynomials up to the fourth order have been used with a scale factor proportional to cos θ, where θ is the angle of incidence, and each coefficient of the polynomial has been found to be well expressed by a linear or a quadratic function of cos θ. Values of twelve parameters required to express the angular-dependent distribution have been determined and are tabulated for the cases of 0.5 to 10-MeV electrons incident on aluminum and 2 MeV electrons incident on copper, tin and polystyrene. The r.m.s. relative error, in which the mean is taken with weights proportional to the square of the fitted values, is 4.2% in the worst case. (auth)

23519 TREATMENT PLANNING USING AN ADVANCED CALCULATOR. Fung, G. S.; O'Brien, P. F. (Calgary Cancer Clinic, Alberta). J. Can. Ass. Radiol.; 25: No. 4, 287-294(Dec 1974).

In January 1971, the Calgary Cancer Clinic adopted a system of routine dosimetry using an advanced calculator which is entirely technician-operated. With the acquisition of an X-Y plotter the next year, isodose plotting became possible and programs were designed to produce multi-portal planar distributions using a 21 × 21 matrix grid system. The ease of operation and low cost funding could make it a practical alternate for "small" radiotherapy centres. (auth)

23520 CRITERIA FOR THE APPLICABILITY OF LET. Kellerer, A. M.; Chmelevsky, D. (Columbia Univ., New York). Radiat. Res.; 63: No. 2, 226-234(Aug 1975).

Linear energy transfer is only one of the factors which determine energy deposition in microscopic regions. Other factors are the range of charged particles, energy loss straggling, and energy dissipation by delta-rays. Graphs are presented delineating those regions of site diameters and particle energies for which the individual factors are important. In the case of protons and other heavy ions one finds a substantial interval of site diameters and particle energies for which the LET concept is appropriate, i.e., where LET is the only relevant factor. No such interval exists for electrons. (auth)

23521 APPLICATIONS OF MICRODOSIMETRY TO MODELS OF CELL SURVIVAL. I. Payne, M. G.; Garrett, W. R. (Oak Ridge National Lab., TN). Radiat. Res.; 63: No. 2, 201-210(Aug 1975).

The problem of incorporating track structure into cell survival models is discussed. We look at the track structure problem in terms of the primary particles (X rays, electrons, or heavy ions) imparting energy which shows up along the track and as electrons originating at the track with an energy and angular distribution characteristic of the type of primary particles. The ejected elec-

trons and other electrons resulting from their collisions are then responsible for depositing energy at points off the primary particle path. We point out the possibility of separating the problem of energy transport away from the track by electrons from the problem of direct interaction of the primary particles. Possible collective effects are incorporated only crudely by adjusting the LET to fit experiment. Our discussion of track structure is closely related to previous work by Roesch and Glass. A cell survival model which is closely related to that of Roesch in the case of low LET radiation is developed for heavy ion, electron, or gamma radiation of arbitrary LET and is compared with the RBE theory of Kellerer and Rossi. Our cell survival models offer another possibility for dealing with survival data with heavy ions of varying type and energy. (auth)

23522 DOZIMETRIIA ELEKTRONNOGO IZLUCHENIIA. (Dosimetry of Electron Radiation). Baranov, V. F. Moscow; Atomizdat (1974). 232p.

Analytical and numerical tabular data are presented on the differential and integral characteristics of fields of electron and beta radiation passing through a finitely thick layer of matter or propagating in a semi-infinite medium. The fundamental processes in the interaction of electrons of less than 10-MeV energy with matter are investigated. The results of Monte Carlo calculations of the main characteristics of fields of electron radiation scattered in light media are presented. (IAA)

Radiation Protection Standards

Refer also to abstracts 22640 and 22956.

23523 (AED-CONF-75-141-006) EXPERIENCE WITH THE LiF THERMOLUMINESCENCE DOSIMETERS. Applications With Low-Energy X-rays. Leitz, W.; Frost, D.; Ribbe, W. 1975. 7p. (In German). INIS.

From 6th scientific symposium of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

2 figs.; 1 tab.; 3 refs. With abstract.

The reproducibility of LiF thermoluminescence dosemeters was studied. Pretreatment of the TLD's before irradiation turned out to be critical. The article deals with the solution of this problem and with the possible causes of measuring errors. Two examples of possible uses of TLD's are given: (1) in mammography, the radiation exposure of the mammary gland by some common methods was recorded; and (2) in operations carried out with the aid of X-ray picture amplifiers, partial body doses of the members of the operation team were measured. The highest radiation exposure values were measured near the hands of the surgeons and at gonad level in front of the lead protection. (GE)

23524 (BNWL-1855) SHIELDING CALCULATIONAL SYSTEM FOR PLUTONIUM. Zimmerman, M. G.; Thomsen, D. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1975. Contract E(45-1)-1830. 87p. Dep. NTIS $5.45.

A computer calculational system has been developed and assembled specifically for calculating dose rates in AEC plutonium fabrication facilities. The system consists of two computer codes and all nuclear data necessary for calculation of neutron and gamma dose rates from plutonium. The codes include the multigroup version of the Battelle Monte Carlo code for solution of general neutron and gamma shielding problems and the PUSHLD code for solution of shielding problems where low energy gamma and x-rays are important. The nuclear data consists of built in neutron and gamma yields and spectra for various plutonium compounds, an automatic calculation of age effects and all cross-sections commonly used. Experimental correlations have been performed to verify portions of the calculational system. (23 tables, 7 figs, 16 refs) (auth)

23525 IONIZING RADIATION: PRESENT VALUES TOO STRICT. Lingjaerde, R. Tek. Ukebl.; 122: No. 26, 10-11 (12 Jul 1975). (In Norwegian).

The values of the allowable radiation doses accepted by the NCRP in 1971, which were with minor exception the same as those recommended by the ICRP in 1965, have been reviewed, along with the report of a UN scientific committee on "The Effects of Atomic Radiation" (1972) and the US National Academy of Sciences Advisory Committee on "The Biological Effects of Ionizing Radiation" (BEIR committee). It is concluded in NCRP report No. 43 that it is not necessary to revise the recommendations and conclusions in NCRP report No. 39. These reports are discussed and it is concluded that the present allowable radiation doses are unnecessarily conservative. (NO)

23526 RADIATION EXPOSURE OF PATIENTS IN X-RAY DIAGNOSTICS WITH AND WITHOUT IMAGE INTENSIFIER TELEVISION EQUIPMENT AND OF THE MEDICAL TEAM DURING WORK IN THE OPERATING THEATRE. Heegemann, C. Freiburg i. B.; Univ. Freiburg i. B. (1973). 60p. (In German). INIS.

Thesis.

A total of 105 radiation dose measurements were carried out to determine the radiation exposure of patients during irradiation with a chain of image intensifier television monitors. The results were compared with values from similar investigations with the conventional irradiation method. Furthermore, 54 measurements were taken to determine the radiation exposure of the medical team during osteosynthetic operations. Here, the average radiation exposure per week for the operating surgeon was 40.5484% of the present maximum permissible dose for persons occupationally exposed to radiation. The other values were 47.9417% for the first assistant and 8.4082% for the second assistant. (GE)

Radiation Source Calibration and Standardization

Refer also to abstracts 22303, 22484, and 23521.

23527 PRESENT PROBLEMS IN IONIZING RADIATION DOSIMETRY. Guiho, J. P.; Le Gallic, Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Lab. de Metrologie des Rayonnements Ionisants). pp 379-388 of 8th Congres National sur le Controle des Rayonnements Ionisants. Chatenay-Malabry, France; Association des Techniciens Superieurs en Radioprotection (1973). (In French)

From 8th congress of the Health Physicist's Association; Chatenay-Malabry, France (5 Jun 1973).

One of the essential problems the medical and industrial user of radiations is up against is to achieve and retain correct calibration of his work dosemeter for the various types of beams utilized. The accuracy as to the doses delivered is directly linked to that of this calibration. To do so, attention is drawn to the importance of defining references and that two kinds of references can be considered; the references are either appropriate detectors or they are photon beams. It is the latter assumption that has been chosen and developed. (FR)

23528 STANDARDIZING ^{125}I SOURCES AND DETERMINING ^{125}I COUNTING EFFICIENCIES OF WELL-TYPE GAMMA COUNTING SYSTEMS. Horrocks, D. L. (Beckman Instruments, Inc., Irvine, CA). Clin. Chem.; 21: No. 3, 370-375(Mar 1975).

The technique for determining the absolute decay rate of any ^{125}I source is described. The problems of varying counting efficiency, varying sample geometry, and extended sources are discussed. By using the calibrated ^{125}I source, the counting efficiency of the given counting system was obtained. (7 figs) (auth)

Shielding Calculations and Experiments

23529 MODERN TRENDS IN RADIATION SHIELDING RESEARCH. Mashkovich, V. P.; Tsypin, S. G. At. Energ. (USSR); 38: No. 6, 398-400(Jun 1975). (In Russian).

This report is concerned with the principal directions of experimental research in the field of radiation shielding, including basic experiments to check methods and constants used, model experiments in shielding actual installations, and full-scale measurements to compare experimental data with calculated radiation fields beyond the shielding of working nuclear installations such as reactors of nuclear power plants and particle accelerators. Characteristic features of modern research are examined, and the place of experiments in the overall study of the problem of shielding from radiation penetration is analyzed. Problems requiring further investigation are discussed. (auth)

PHYSICS (THEORETICAL)

General

Refer also to abstract 23397.

23530 PROBLEMY PRIKLADNOI MATEMATIKI I MEKHANIKI. Sbornik, Statei. (Problems of Applied Mathematics and Mechanics. Collection of Articles). Bogolyubov, N. N. Moscow; Izdatel'stvo Nauka (1971). 283p.

The collection consists of about 30 articles dealing with a whole series of modern problems in applied mathematics and mechanics. The scientific work of A. A. Dorodnitsyn in atmospheric physics is reviewed in the opening article. Then a number of studies follow on control theory (Theory of games, dynamic systems and prognosis, program planning and optimal control.) In a number of articles an analysis is carried out of the behavior of the solutions of ordinary differential equations. Problems are considered for developing mathematical accuracy and programing on a computer, design selection, and validation of difference schemes to solve boundary problems of equations with partial derivatives. A number of studies develop numerical and analytical method of investigating problems of mechanics, hydrodynamics and the theory of plasticity. New results were obtained on investigating transonic gas flow, combustion in supersonic flow, gas movement during solar flares, flow of a viscous liquid, and streamline flow. The solar flare article is abstracted separately in this issue. (SJR)

For an abstract of an individual paper see: 23146.

23531 LOCAL PROPERTIES OF MANY PARTICLE SYSTEMS IN A DE SITTER-INVARIANT QUANTUM MECHANICS. Smilga, W. Tuebingen, Ger.; Univ. Tuebingen (1972). 59p. (In German). INIS.

Thesis.

The quantum mechanical problem of measurement is discussed in detail for the de Sitter space. The equations of motion are formulated for a many-particle system, whose space of states is the direct product of spaces of one-particle states, defined through a de Sitter invariant generalization of the Dirac equation. The local observable consequences of these many-particle equations of motion are discussed. The pair production, the structure of the physical vacuum and the conservation of lepton number are described in connection with the formulation used. (GE)

23532 CLEBSCH-GORDAN COEFFICIENTS OF THE LORENTZ GROUP. Verdiev, I. A.; Kerimov, G. A.; Smorodinskii, Ya. A. (Inst. of Physics, Baku). Yadern. Fiz.; 21: No. 6, 1351-1361(Jun 1975). (In Russian).

The Clebsch–Gordan coefficients for irreducible representations of the Lorentz group are calculated in the basis with quantum numbers j_1, j_2, $\frac{1}{2}(m + ir)$. The earlier calculated transformation matrices are used for the transition to the canonical basis. (auth)

Quantum Field Theories

Refer also to abstract 23541.

23533 (COO-3075-63) FREE FIELD THEORY OF STRINGS. Ramond, P. (Yale Univ., New Haven, Conn. (USA). Dept. of Physics). 1974. 29p. (CONF-740135-1). Dep. NTIS $4.50.

From Johns Hopkins workshop on current problems in high energy particle theory; Baltimore, Maryland, USA (18 Jan 1974).

The quantum field theory of extended objects is developed considering only free fields and emphasizing an understanding of the classical field theory. A general overview of the requirements which must be met by the field is given, and it is shown that relativistic invariance may be achieved only by increasing the number of dimensions to 26 at the level of classical theory. A generalization of Noether's theorem is presented along with an action principle derivation leading to extraction of the Poincare group generator. It is shown how to quantize the theory and concluding remarks are made relating gauge invariance and interaction of these models. (1 figure) (SDF)

23534 (HU-P-74-80) STRAIGHT-LINE PATH METHOD IN QUANTUM FIELD THEORY. Kuleshov, S. P.; Matveev, V. A.; Sissakian, A. N.; Smondyrev, M. A.; Tavkhelidze, A. N. (Helsinki Univ. (Finland). Dept. of Nuclear Physics). 1974. 91p. Dep. NTIS (US Sales Only) $7.75.

The mathematical formulation which underlies the straight-line path method in quantum field theory is considered. The suggested approach is based on the representation of Green's functions and the scattering amplitudes in the form of continuous integrals over the particle paths. Some applications of the method to solving problems of high-energy particle interactions are considered, and its connection with the quasipotential description in quantum theory is studied. (auth)

23535 (JINR-P2-8750) QUASIPOTENTIAL EQUATION IN NULL-PLATE QUANTUM FIELD THEORY AND FORM FACTORS OF COMPOSITE SPINOR PARTICLES. Khelashvili, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 36p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

The problem of the two-particle bound state in null-plane quantum field theory is considered, and the Bethe-Salpeter type equation is derived. It is shown that the Green functions and the Bethe-Salpeter amplitudes as well have projective properties with respect to the spinorial constituents. This fact extremely simplifies considerations in the frame where both particles are on the same null-plane. The corresponding quasipotential equation is obtained. The expressions for the current matrix elements of composite particles are derived, and it is shown that in the lowest order of perturbation theory the quasipotential approach reproduces all results on composite particle form factors that were obtained in the framework of the "old-fashioned perturbation theory" in infinite momentum frame. (auth)

23536 TWO-BODY PROBLEM OF ELECTRODYNAMICS. Scherrer, W. Helv. Phys. Acta; 47: 645-665(1974). (In German).

The interaction between electrons and positrons, classically defined in the Newtonian framework, can be directly transferred to the special relativity theory. The problem of the corresponding phases is proven. The classical simultaneity must be replaced by the relativistic signal combination. A working principle in the form of an invariant line integral was introduced, which contains, in addition to the known kinetic terms, a relativistic Coulomb potential. The resulting equations of motion are in principle completely calculable. The most important result, aside from an insignificant restriction, is a proof of the following statement: There is an abundance of stationary solutions with large or small total energy if the total momentum is sufficiently large. This statement is only a result of the relativity theory and therefore independent of the quantum theory. There remains open the question of whether a quantization is necessary or possible. (tr-auth)

23537 SCHROEDINGER EQUATION IN THE BASIS OF ANGULAR POTENTIAL FUNCTIONS. Bursak, A. V.; Gorbatov, A. M. (Kalinin State Univ., USSR). Yadern. Fiz.; 21: No. 6, 1347-1350(Jun 1975). (In Russian).

Canonical representation of potential harmonics is obtained in the method of hyperspherical functions. (auth)

23538 VACUUM POLARIZATION OF THE CHARGED VECTOR FIELD IN THE RENORMALIZED THEORY. Skalozub, V. V. (Leningrad State Univ.). Yadern. Fiz.; 21: No. 6, 1337-1346(Jun 1975). (In Russian).

Non-linear corrections are presented for the Lagrangian stemming from the vacuum polarization of the charged vector field by constant electromagnetic and scalar fields in renormalized electrodynamics based on spontaneous breaking of the local SU(2) symmetry. The efficient Lagrangian of the interaction between scalar and electromagnetic fields is obtained and the lifetime of the scalar particles is estimated. The character of behaviour of renormalized electric charge in the second and in the fourth order of perturbation theory is under consideration. In this connection the non-linear corrections to the Lagrangian due to the interaction of the vector field in the vacuum are calculated. (5 figures) (auth)

23539 PROCESSES AT THE BOUNDARY OF VACUUM DOMAINS. Voloshin, M. B. (Moscow Physical-Technical Inst.). Yadern. Fiz.; 21: No. 6, 1331-1336(Jun 1975). (In Russian).

The features of the mass spectra of particles of a pseudoscalar field with a vacuum domain and of the fermions interacting with the field are considered. The transparency of the domain boundary for particles is also discussed. The mass spectrum of one-body states of the pseudoscalar field is found. It is shown that in the one-body approximation free particles of that field do not reflect from the boundary. The reflection coefficient for fermions is calculated in the same approximation. (auth)

Gravitation and General Relativity

Refer also to abstract 23079.

23540 (IFA-FR-126-1975) USING THE SUN GRAVITATIONAL FIELD FOR DETERMINING THE VELOCITY OF THE GRAVITATIONAL INTERACTION IN THE CASE OF NEWTONIAN GRAVITATIONAL FIELDS. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 9p. Dep. NTIS (US Sales Only) $4.00.

An experiment was previously proposed for determining the velocity of the gravitational interaction of the Newtonian gravitational fields. The measurement is made by determining the phase difference between the moon gravitational potential theoretically determined, the distance being known at every instant of the natural earth satellite from the earth spot where the experiment is carried out and an experimental curve of the moon gravitational potential as measured on the earth or aboard an artificial satellite of the latter. An experiment is proposed to develop within the sun gravitational field. As a result of the long propagation time of the sun-earth gravitational interaction, a large time error margin will result in the determination of the time phase difference between the theoretical and experimental curves. Therefore, even if the gravimetric measurements are not of the highest accuracy, the error obtained in determining the velocity of the gravitational interaction propagation is acceptable. In the case of a time phase difference error $\Delta t = 10$ s, it is estimated that the resulting error in determining the velocity of the gravitational interaction will be under 5%. (auth)

23541 ENERGY-MOMENTUM TENSORS AS SOURCES OF SPIN-2 FIELDS. Lord, E. A. (Indian Inst. of Science, Bangalore, India). Pramana.; 5: No. 1, 29-32(Jul 1975).

The improvement terms in the generalized energy–momentum tensor of Callan, Coleman and Jackiw can be derived from a variational principle if the Lagrangian is generalized to describe coupling between "matter" field and a spin-2 boson field. The required Lorentz-invariant theory is a linearized version of Kibble–Sciama theory with an additional (generally covariant) coupling term in the Lagrangian. The improved energy–momentum tensor appears as the source of the spin-2 field, if terms of second order in the coupling constant are neglected. (auth)

23542 SINGULARITIES IN GLOBALLY HYPERBOLIC SPACE–TIME. Clarke, C. J. S. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Commun. Math. Phys.; 41: No. 1, 65-78(Mar 1975).

A singularity reached on a timelike curve in a globally hyperbolic space-time must be a point at which the Riemann tensor becomes infinite (as a curvature or intermediate singularity) or is of type D and electrovac. (auth)

REACTOR TECHNOLOGY AND REGULATION

23543 (ANCR-1177) NUCLEAR TECHNOLOGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1974. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Jan 1975. 570p. Dep. NTIS $13.60.

Abstracts of research projects are presented concerning nuclear properties, general reactor development and support, test reactor operations support, LOFT support, PBF support, FEFPL support, TRSP support, techniques and instrumentation, non-nuclear energy sources, and related activities of division personnel. (DCC)

23544 (BNWL-B-435) AVAILABILITY OF USEFUL ISOTOPES FROM CIVILIAN NUCLEAR POWER REACTORS TO THE YEAR 2000. Heeb, C. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1975. Contract E(45-1)-1830. 36p. Dep. NTIS $4.00.

Various fission product and actinide isotopes are present in fuels discharged from nuclear power reactors. Many of these isotopes have potential for beneficial use such as generators of thermal and/or electrical energy. Knowledge of the character and amount of these isotopes present in fuels discharged from nuclear power reactors is needed to define the current and potential use of these by-products and methods of recovery. Thus, the purpose of this study was to make a preliminary estimate of the cumulative amount from all reactors in the U. S. civilian nuclear power economy of each of those isotopes deemed as having the greatest potential for application. The time period covered is from 1972 to the year 2000. (auth)

23545 (CONF-7310110-) CONFERENCE ON NUCLEAR POWER PLANTS AND CONTAINMENT, BRNO, CZECHOSLOVAKIA, OCTOBER 3–5, 1973. Hatle, Z. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1974. 86p. (In Several Languages). Czechoslovak Atomic Energy Commission, Zbraslav nad Vltavou.

The six papers presented at the working conference are compiled. The conference considered three aspects of nuclear power: safety of nuclear power plants in densely populated areas, designs and economics of nuclear power plants, and development of reactors as heat sources. The extended discussions held at the end of each section and a concluding summarizing statement are also included. Separate abstracts were prepared for four of the papers. Abstracts for the remaining two papers have previously appeared in NSA. (JSR)

For abstracts of individual papers see: 23919, 24033, 24034, and 24055.

23546 POWER REACTORS 1975. Annual Directory of Data on the World's Power Reactors. Nucl. Eng. Int.; 20: No. 229, 385-440(Apr 1975).

An alphabetical listing is given of the world's nuclear power plants with cross references to three sections which provide information as follows: (1) general data such as location, owner, contractor, cost, etc; (2) technical parameters for all stations listed according to reactor type; and (3) progress schedules in the form of bar graphs showing operating performance or construction progress for each reactor. (UK)

23547 NUCLEAR POWER INDUSTRY IN ITALY. Riccio, G. (Forum Italiano dell'Energia Nucleare, Rome). Energ. Nucl. (Milan); 22: No. 6, 314-319(Jun 1975).

From 20th nuclear congress; Rome, Italy (20 Mar 1975).

Projected electric power needs in Italy up to the year 2000 are outlined. A picture of the capacities of the Italian nuclear industry is drawn in both the fuel cycle and the nuclear power plants or their components. The Italian role in the national and international frame is also examined for advanced and fast reactors. The conclusion is drawn that the Italian nuclear industry, from the technical and organizational point of wiew, is prepared–in principle and under certain conditions–to face the important engagements deriving from the national nuclear power program caused by the energy crisis. (auth)

23548 NUCLEAR POWER PLANTS IN THE WORLD. Fiorentini, P. Com. Naz. Energ. Nucl., Not.; 21: No. 3, 41-76(Mar 1975). (In Italian).

A review is presented of the world's nuclear power plants in operation, under construction and in the design stage as of March 31, 1975. An introductory survey briefly outlines the state of nuclear programs with particular reference to the problems that most affect their development and implementation. A set of tables shows the main characteristics (location, owner, nuclear section supplier and buidler, type, capacity, entry into service, power generated, etc.) of each plant. (auth)

23549 ROLE OF R AND D BODIES IN THE ACCELERATION OF NUCLEAR POWER PROGRAMS. Clementel, E. (CNEN, Rome). Com. Naz. Energ. Nucl., Not.; 21: No. 4, 21-30(Apr 1975). (In Italian).

From 20th nuclear congress; Rome, Italy (Mar 1975).

The worldwide energy crisis has faced all industrialised countries with the problem of accelerating energy research and development programs for the dual purpose of rationalizing energy consumption and utilizing alternative sources. The proposed short—and medium—term effort is focused on the use of nuclear energy for electric power generation. This new situation has had a particular impact on research agencies and on the role which they will be called upon to play in the future. The research demand coming in the short term from the nuclear power plant construction programs in the various countries concerns, besides a substantial support to the action programs of nuclear industries, also the solution of all problems involved in the supply of raw materials, such as natural and enriched uranium, as well as the sectors concerned with fuel element fabrication and reprocessing, radioactive waste treatment and disposal, and finally with plant safety controls and protection of the environment and man. The medium—and long—term research demand is concerned on the one hand with the development of new reactor types capable of making a more efficient use of the energy content of uranium, on the other with the utilization of new sources, such as nuclear fusion, solar energy, geothermal energy and a more efficient utilization of conventional sources. (auth)

23550 AIR POLLUTION CONTROL AND INDUSTRIAL ENERGY PRODUCTION. Noll, K. E.; Davis, W. T.; Duncan, J. R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers Inc. (1975). 367p. $22.50.

Information is provided on industrial pollution source monitoring methods; particle, gas, and odor control technology; and air pollution control for power generation. One section dealing with LMFBR environmental impact was separately abstracted and indexed for NSA. (DG)

For an abstract of an individual section see: 23965.

23551 TENTH SPACE CONGRESS; TECHNOLOGY TODAY AND TOMORROW, COCOA BEACH, FLORIDA, APRIL 11–13, 1973. Cape Canaveral, FL; Canaveral Council of Technical Societies (1973). vp. (CONF-730493-).

A separate abstract was prepared for the one paper which was in scope for NSA. (TSS)

For an abstract of an individual paper see: 23552.

23552 REGIONAL AND GLOBAL ENERGY TRANSFER VIA PASSIVE POWER RELAY SATELLITES. Ehricke, K. A. (Rockwell International Corp., Downey, CA). pp 5.15-5.94 of Tenth Space Congress, Technology Today and Tomorrow. Cape Canaveral, FL; Canaveral Council of Technical Societies (1973).

From 10th space congress; Cocoa Beach, Florida, USA (11 Apr 1973). See CONF-730493-.

The possibilities of the use of satellites for the microwave transmission of power from various types of power plants, including nuclear, are examined. (TJJ)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 23933, 23934, 23940, 24026, 24060, and 24062.

23553 (CONF-701074-P3, pp 695-722) OPERATING RELIABILITY OF WELDED HIGH-PRESSURE VESSELS. Alekseenko, N. N.; Gorynin, I. V.; Efimov, A. V.; Razov, I. A. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Questions of the reliability of welded high-pressure vessels for nuclear service are examined. The basis of evaluation of the operating reliability of high-pressure vessels was the concept of the temperature-viscosity reserve of a structure. Corresponding to that concept is the scheme of brittle strength proposed for structural designs and extended to reactor vessels through the additional consideration of factors of thermal aging and neutron

irradiation. An additional experimental substantiation is given for the brittle strength scheme, one obtained in tests of welded large samples of 15CrMoFA steel with pulsed induction of brittle cracks. Experimental data are presented on the influence of long thermal aging and neutron irradiation on change of the brittle tendency of the metal of welded seams of 15Cr2MoFA steel used to make the vessels of water-moderated water-cooled reactors. (auth)

23554 (CONF-750617-15) EXPERIMENTAL AND ANALYTICAL STUDY OF LIQUID AND TWO-PHASE FLOW INDUCED VIBRATION IN REACTOR FUEL BUNDLES. Gorman, D. J. (Ottawa Univ., Ontario (Canada)). 1975. 11p. American Society of Mechanical Engineers, New York.

From 2nd ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

An instrumented cylindrical tube simulating a reactor fuel pin was subjected to vibration tests in the central position of a seven-element bundle. Tests were conducted with two-phase air-water mixtures and liquid flow. The objective was to establish the effects of mass flow rates and void fractions on the amplitude of vibration. It was found that the amplitude became less dependent on two-phase flow rates as the flow rates were increased. It was also found that for fixed mass flow rates, and void fractions simulating steam qualities greater than 16 per cent, no increase in vibration was observed for the range of parameters studied. A simplified analytical formula based on the linear random vibration theory was used to predict response of the pin in two-phase tests. Fairly good agreement was obtained between analysis and experiment. A study was made of the effects which basic parameters have in determining vibration amplitude. (auth)

23555 (NEDO-20648) BWR CHANNEL DEFLECTIONS. (General Electric Co., San Jose, Calif. (USA), BWR Projects Dept.). Jun 1975. 27p. General Electric Co., San Jose, CA.

General Electric Company has more than 12,000 Zircaloy fuel channels in operating reactors. A report is presented which discusses the occurrence of permanent channel deflections that result from normal plant operation. Included are the details of channel flatness and displacement measurements made at foreign reactors, a comparison of the bottom channel measurement location data on all plants to the analytical model, a description of the method used to predict bypass flow, a discussion of the thermal hydraulic effects, and a statistical evaluation of the possibility of control rod interference. (auth)

23556 (NEDO-20772) GENERAL ELECTRIC BOILING WATER REACTOR RELOAD-5 LICENSING SUBMITTAL FOR NINE MILE POINT NUCLEAR POWER STATION, UNIT 1. (General Electric Co., San Jose, Calif. (USA), BWR Projects Dept.). Aug 1975. 48p. General Electric Co., San Jose, CA.

The supplemental information for Reload-5 at the Nine Mile Point 1 Nuclear Power Station is presented. The design reference core loading is based on the use of as many as 200 8 x 8 bundles having an average enrichment of 2.50 wt percent U-235. The objective of this outage is to load the reactor core to ensure sufficient reactivity to operate the 532 element core at a licensed power level of 1850 MW(t) for an approximate 18-month cycle. 4 references. (auth)

23557 (RP-8A) RADIATION SHIELDING DESIGN AND ANALYSIS APPROACH FOR LIGHT WATER REACTOR POWER PLANTS. (Stone and Webster Engineering Corp., Boston, Mass. (USA)). May 1975. vp. Stone and Webster Engineering Corp., Boston, MA.

This topical report is intended to serve as a generic summary of the Stone and Webster Engineering Corporation radiation shielding design and analysis approach for light water reactor power plants. The application of this approach to a typical Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) plant is described. This description includes a discussion of radiation zoning throughout the plants, radiation sources, and the sizing of shielding of their sources to reduce radiation levels to meet the requirements of each zone. The methods of analysis and basic physics data which are employed are described or referenced. 47 references. (auth)

23558 STATUS AND DEVELOPMENT OF WATER REACTORS FOR POWER GENERATION. Altvater, W.; Weber, D. M. (Kraftwerk Union A. G., Erlangen, Ger.). pp 1-24 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Electricity requirements and the future role of nuclear power in electricity generation in various areas of the world are discussed. Descriptions are given of the development and the main components, particularly the coolant systems, for the different types of water cooled reactors. These include BWRs, PWRs, and in briefer context, CANDU type reactors, the SGHWR system, and reactors of the USSR. Operating experiences of nuclear power stations of the Western World, exceeding 20 MWe, are examined. These include 14 BWRs, 15 PWRs, 4 heavy water reactors, and 19 CO_2-cooled graphite moderated reactors. For each type an analysis is made of the troubles encountered, e.g. turbine damage, pipe leaks, pump failures, corrosion troubles, and other defects. It is considered that most outages are caused by teething troubles which can be eliminated eventually. The measures to be taken in the future development of water cooled reactors are discussed. (UK)

23559 HYDRAULIC PROBLEMS IN THE DEVELOPMENT OF REACTOR PUMPS. Florjancic, D. (Sulzer-KSB Kernkraftwerkspumpen, G.m.b.H., Frankenthal, Ger.). pp 25-33 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The different design elements of LWR primary coolant pumps such as the hydraulic parts, the radial thrust in relation to the specific speeds and their effect on the water lubricated journal bearing are discussed together with pump testing procedures. After the hydraulic form, sealing arrangement, and bearings have been individually tested, they are tested together on a pump under normal and extreme operating conditions. Tests on a prototype machine give information relating to the various influences under variable operating conditions. The new testbed at Frankenthal, with an installed power of 12 MW, is described together with an explanation of the tests which may be undertaken. (auth)

23560 DEVELOPMENT OF A GLANDLESS REACTOR INTERNAL PUMP. Newbould, F. R. (Hayward Tyler and Co., Ltd., Luton, Eng.); Roberts, A. E.; Tornblom, L. pp 33-43 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

One of several advantages of the glandless internal main recirculation pump compared with pumps in external loops is that the space requirements and layout of the reactor containment can be made appreciably more compact. The advantages of internal pumps are discussed with reference to a typical reactor containment. Direct contact with the reactor primary coolant presented many unusual mechanical design problems. The general design concept of the reactor internal pump and relevant background experience of glandless units are discussed in some detail, as are some novel design solutions which were required to overcome maintenance problems. The restricted space available inside the reactor vessel for the pump impeller and diffuser and the requirement for a high efficiency and low N.P.S.H. requirement lead to the selection of a mixed flow pump and a decision to conduct model tests. Pump reverse flow characteristics are particularly important in valveless systems, and tests were conducted on the model to provide data for a full evaluation of the consequences of various failure conditions. Special features of the hydraulic design are discussed and comparison is made between the model and prototype tests. In order to thoroughly test the behavior of the pump unit during all operating conditions and to define and prove handling procedures, a full scale test rig was built and results are presented of a comprehensive program of tests. It is shown that a close collaboration between a pump maker and a reactor builder resulted in the development of a recirculation pump of high integrity and reliability. (auth)

23561 STEEL CASTINGS FOR NUCLEAR POWER PLANT PUMPS. Kamber, F. W. (George Fischer Ltd., Schaffhausen, Switzerland). pp 53-58 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Steel castings used for reactor coolant pumps must be of high quality and manufactured strictly in accordance with customer specifications. Basic foundry requirements necessary for the manufacture of high quality steel castings for the nuclear field are discussed, and certain features of nuclear steel castings based on ASME code requirements are mentioned. Brief explanation is given of some different types of pump case castings together with background experience. (auth)

23562 ANDRITZ MAIN COOLANT PUMPS FOR NUCLEAR POWER STATIONS. Moritz, G. (Maschinenfabrik Andritz A. G., Graz-Andritz, Austria). pp 59-65 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Main coolant pumps for pressurized water and boiling water reactors are described with particular consideration of the pumps for pressurized water reactors. In addition to the hydraulic and mechanical design, the auxiliary systems required for operation, and the pump testing methods used are described. (auth)

23563 JET PUMP DEVELOPMENT FOR BOILING WATER REACTORS. Kudirka, A. A.; Gluntz, D. M. (General Electric Co., San Jose, CA). pp 75-82 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Jet pumps have been developed for coolant recirculation in boiling water reactors to reduce the number of external loops and to provide a more compact system. These jet pumps are used inside the reactor pressure vessel to circulate subcooled water at about 530°F. The performance and geometry of the first-generation and improved second-generation jet pumps are surveyed, and the economic advantages of using them in a reactor are discussed. The development and innovative features of the second-generation jet pump, which operates with the highest efficiency reported, are described. (auth)

23564 DESIGN, PERFORMANCE, AND OPERATION OF JET PUMPS RECIRCULATION SYSTEMS FOR BWRs. Fitzsimmons, G. W.; Gluntz, D. M. (General Electric Co., San Jose, CA). pp 83-90 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Jet pump recirculation systems have been operating in ten BWRs presently in commercial operation, each exhibiting exemplary reliability and performance capabilities. Another twenty-six BWRs currently in various stages of design, construction, and startup testing similarly utilize this original system version. An improved system was introduced in 1969 and has since been applied to an additional thirty-eight BWRs. Basic aspects of the design and performance features of each recirculation system type are presented, together with a brief survey of experience history concerned particularly with jet pump operation. (auth)

23565 DESCRIPTION OF PUMPS USED IN CURRENT DESIGNS, LIGHT WATER NUCLEAR REACTOR POWER PLANTS IN THE USA. Richardson, J. A. (Burns and Roe, Inc., Oradell, NJ). pp 91-108 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Detailed information is provided on pumping plants used in light water nuclear reactor power plants currently in design in the USA. Equipment discussed includes the reactor primary coolant circulation pumps, primary coolant purification and make-up pumps, engineered safeguards pumps, spent fuel pool storage cooling and radioactive waste handling pumps, closed cooling water pumps, and ultimate heat sink cooling water systems pumps. Specific design characteristics of the conventional pumping plant used in wet saturated steam turbines are also identified. The design and manufacturing codes currently in force are specified and particular design requirements such as seismic and loss of coolant accident (LOCA) dynamic loadings are discussed. Observations are made on current problem areas for the subject pumping plant and speculations for future designs. (auth)

23566 COOLING NUCLEAR REACTOR FUEL. Redpath, W.; Read, R. W. (to United Kingdom Atomic Energy Authority). British Patent 1,386,153/B/. 5 Mar 1975. Filed date 29 Mar 1972. 4p.

Reference is made to water cooled reactors having cluster type fuel elements. Such fuel elements are normally cooled by the passage of main coolant through the cluster parallel to the surface of the fuel rods. The object of the arrangement described is to provide auxiliary cooling for the cluster by means of coolant sprays directed transversely to the direction of the main coolant. A shroud surrounding the cluster is provided with a number of conduits for directing the auxiliary coolant into the cluster from a common header. (UK)

23567 ACOUSTIC EMISSION TESTING OF THE GUNDREMMINGEN NUCLEAR POWER PLANT PRIMARY SYSTEM. Ettemeyer, R. (Kernkraftwerk RWE-Bayernwerk G.m.b.H., Gundremmingen/Guenzburg (F. R. Germany)); Hauptfleisch, D. (Exxon Nuclear Co., Brussels (Belgium). Nuclear Services Europe Div.). Atomwirtsch., Atomtech.; 20: No. 4, 182-186 (Apr 1975). (In German).

The method of acoustic emission analysis was used in the pressure test of the primary system of the RWE-Bayernwerk nuclear reactor (KRB), Gundremmingen. The test method, the results, and the possible future uses of the method are discussed. (GE)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 23553, 23557–23559, 23561, 23562, 23565, 23566, 23940, 23954, 23957, 23964, 24026, 24034, and 24056.

23568 (BAW-10097(Rev.2)) MARK C (17 x 17) FUEL ASSEMBLY, Research and Development, Revision 2. Stoudt, R. H.; Kern, R. C.; Walton, L. A. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jul 1975. 14p. Babcock and Wilcox, Lynchburg, VA.

The research and development programs related to the B and W Mark C (17 x 17) fuel assembly are described. The programs are designed to provide data for analytical models, confirm predictions, and verify the adequacy of the design. A general description of the Mark C assembly is presented along with comparisons to the Mark B (15 x 15) fuel assembly. The report is organized in three main test areas: (1) mechanical and hydraulic, (2) critical heat flux, and (3) rod swelling and burst. The test program scopes and objectives are discussed along with the test methods. (auth)

23569 (BNL-20307) MATERIALS PERFORMANCE IN OPERATING PWR STEAM GENERATORS. Weeks, J. R. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 22p. (CONF-750911-3). Dep. NTIS $4.25.

From international conference on materials for nuclear steam generators; Gatlinburg, Tennessee, USA (9 Sep 1975).

The Inconel-600 tubing in operating PWR steam generators has developed leaks due to intergranular stress corrosion cracking or a general wastage attack, originating from the secondary side of the tubing. Corrosion has been limited to those areas of the steam generators where limited coolant circulation and high heat flux have caused impurities to concentrate. Wastage or pitting attack has always been associated with local concentration of sodium hydrogen phosphates, whereas stress corrosion has been associated with local concentration of sodium or potassium hydroxides. The only instance of stress corrosion originating from the primary side occurred on cold-worked tubing when hydrogen was not added to getter oxygen, and LiOH was not added to raise the pH of the primary coolant. All PWR manufacturers are now recommending that the phosphate treatment of the secondary coolant be abandoned in favor of an all-volatile treatment. Experience in operating plants has shown, however, that removal of phosphate-rich sludge deposits is difficult, and that further wastage and/or intergranular stress corrosion may develop; the residual sodium phosphates gradually convert by reaction with corrosion product hydroxides to sodium hydroxide, which remains concentrated in the limited flow areas. Improvements in circulation patterns have been achieved by inserting flow baffles in some PWR steam generators. Inservice monitoring by eddy current techniques is useful for detecting corrosion-induced defects in the tubing, but irreproducibility in field examinations can lead to uncertainties in interpreting the results. (auth)

23570 (CONF-701074-P3, pp 600-647) BASIS OF SELECTION OF ZIRCONIUM ALLOY FOR THE JACKETS OF NUCLEAR FUEL ELEMENTS OF THE SERIAL POWER REACTOR-VVER-440. Amaev, A. D.; Ambartsoomyan, R. S.; Anisimova, I. A. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Basic results of the investigations of structure, stress-strain and corrosion properties, and tendency towards hydrogenation of zirconium alloy with 1% of niobium (Alloy H-1), used in fuel element jackets of VVER type reactors, are presented. The results of loop tests of the experimental fuel elements with jackets made from alloy H-1 in the MP reactor are discussed, as well as investigations of these fuel elements in the hot laboratory. A description of the data obtained on fuel elements studied in the VVER–1 reactor is given. The choice of material for fuel-element jackets for VVER–440 reactors is based on experiments carried out. (auth)

23571 (EUR-5315d) OBRIGHEIM NUCLEAR POWER PLANT. Annual Report, 1973. (Commission of the European Communities, Luxembourg). 1974. 62p. (In German). Dep. NTIS (US Sales Only) $6.25. EUR BF 125.-.

In 1973 the 345 MW pressurized water nuclear power plant at Obrigheim operated on base load, generating approximately 2.63 TWh, approximately 2.5 TWh of which was supplied to the KWO members. The plant availability for the year was 89.9%. Of the 10.1% non-availability, 6.4% (23 d) was caused by refueling, including inspection, overhaul and repair operations and routine tests carried out in September 1973. 3.3% was due to stoppages for repairs to a steam generator and the two main cooling pumps, while 0.4% resulted from failures in the electrical section of the plant. The plant was shutdown seven times in all, including three scrams. The average core burnup at the end of the fourth cycle (1 September 1973) was 18 900 MWd/tU, representing an average burnup of approximately 37 500 MWd/tU for a fuel element used in all four cycles. The operating performance of the steam generators and the result of the steam generator inspection carried out during refueling in 1973 suggest no progressive damage. (auth)

23572 (JEN-300) PENELOPE-CITATION: CODE SYSTEM FOR NEUTRONICS CALCULATIONS OF NUCLEAR REACTORS USING DIFFUSION THEORY WITH FEEDBACK EFFECTS INCLUDED. Anhert Iglesias, C.; Martinez-Val Penalosa, J. M. (Junta de Energia Nuclear, Madrid (Spain)). 1975. 81p. (In Spanish). Dep. NTIS (US Sales Only) $7.25.

The program description and user's manual of a code system for neutronics calculations of nuclear reactors is described. This system performs from cell's calculations to reactor's calculations, with very simplified transmission of data between them through computer storage interface data files. Included in the diffusion code CITATION are the feedback effects due to burnup water density, fuel temperature, xenon and samarium. 6 references. (auth)

23573 (JEN-303) SOTHIS: A PROGRAM TO CALCULATE FEED ENRICHMENTS AND FUEL COSTS OF PWR EQUILIBRIUM CYCLES. Corella, M. R.; Martinez-Val, J. M. (Junta de Energia Nuclear, Madrid (Spain)). 1975. 79p. Dep. NTIS (US Sales Only) $7.00.

Using an original method, to determine the reactor reactivity, the feed enrichment of an equilibrium cycle specified by its major variables is computed. Fuel cost calculations are performed with this and other related data, according to the economic parameters read in. This code can be useful for preliminary PWR fuel management studies, because of its rapidity, and its data modification facility. (auth)

23574 (LIB/Trans-567) SIGNIFICANCE OF THERMOHYDRAULIC CONDITIONS FOR THE CORROSION SAFETY OF PWR STEAM GENERATORS. Guelich, J. F. Translated by W. Buykx from Atomwirtsch., Atomtech.; 20: No. 2, 82-87 (Feb 1975). 30p. Dep. NTIS (US Sales Only) $4.50.

In several PWR nuclear power plants leakages have occurred in the steam generator which were caused by localised corrosion attack. While the attention of manufacturers and operators is focused on the influences of feedwater chemistry and tube material, the present work highlights the fact that the damage always occurred in those places where flow regimes are poorly defined. The investigation leads to the result that local dry out of the heating surface can be a contributing cause of damage. A method is indicated for estimating the thermohydraulic conditions in the inflow region over the tube plate and measures to improve corrosion safety are discussed. 7 references. (auth)

23575 (WCAP-7912-A) POWER PEAKING FACTORS. McFarlane, A. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jan 1975. 73p. Westinghouse Electric Corp., Pittsburgh.

Information is provided on the design constraints on peak local power density in a Westinghouse PWR, on the values obtainable with established and revised operating procedures, and on the measures taken to preclude exceeding design limits. (auth)

23576 (WCAP-7912-A(Suppl.1)) POWER PEAKING FACTORS. Supplement 1. McFarlane, A. F.; Langford, F. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jan 1975. 56p. Westinghouse Electric Corp., Pittsburgh.

Additional data is presented on how the peak local power density in a Westinghouse reactor is maintained within limits through the use of excore ion chambers. Discussed are design constraints on the peak local power density, values obtainable with established and revised operating procedures and measures taken to preclude exceeding design limits. (auth)

23577 (WCAP-8028-A) TWINKLE: A MULTIDIMENSIONAL NEUTRON KINETICS COMPUTER CODE. Barry, R. F.; Risher, D. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jan 1975. 54p. Westinghouse Electric Corp., Pittsburgh.

The TWINKLE code is a neutron kinetics code which solves the multidimensional, two group transient diffusion equations using a finite-difference technique. The code contains a detailed six-region fuel-clad-coolant transient heat transfer model at each spatial point for calculating doppler and moderator feedback effects. The method of applying feedback corrections to the basic raw cross-sections is patterned after the design nuclear codes presently in use at Westinghouse. The code performs its own steady state initiation. Up to 2000 mesh points can be used, in one, two or three dimensional rectangular geometry. The code has been used for rod ejection, anticipated transients without trip, loop stop valve opening, and other transients. 11 references. (auth)

23578 (WCAP-8030-A) APPLICATION OF MODIFIED SPACER FACTOR TO L GRID TYPICAL AND COLD WALL CELL DNB. Cadek, F. F.; Motley, F. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jan 1975. 45p. Westinghouse Electric Corp., Pittsburgh.

Test data for "L" mixing vane grids from a typical and a thimble coldwall cell test section and test data from a previously completed "L" grid typical cell test section were analyzed using the modified spacer factor. This factor was developed for "R" mixing vane grid typical cells and extended to cold wall cells. A correction factor of .986 must be applied to the "L" grid, to bring the predicted heat flux, using the W-3 correlation with the "R" grid modified spacer factor, into agreement with the measured "L" grid DNB heat flux. 7 references. (auth)

23579 (WCAP-8201-A) EVALUATION OF DNB TEST REPEATABILITY. Hill, K. W.; Motley, F. E.; Cadek, F. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Apr 1975. 53p. Westinghouse Electric Corp., Pittsburgh.

The repeatability of DNB tests was evaluated by carrying out DNB runs at the same conditions in two different test sections. The resulting matched pairs of DNB runs were then subjected to an extensive statistical analysis. This analysis indicates that individual runs using different test sections are repeatable within approximately 8 percent, and that the means of two different data sets should fall within approximately 2 percent of each other. The repeatability within a set, i.e., from the same test section, was found to be approximately 6.4 percent. An evaluation of the uncertainties by analysis of errors inherent in geometrical and physical parameters results in an estimated set-to-set repeatability for an individual run of 7.6 percent which is in good agreement with the 8 percent error found in the data analysis. For repeatability of an individual run within a set, 6.8 percent was estimated from the test parameters, compared to 6.4 percent determined by data analysis. (auth)

23580 (WCAP-8253(Amend.1)) SOURCE TERM DATA FOR WESTINGHOUSE PRESSURIZED WATER REACTORS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jul 1975. 112p. Westinghouse Electric Corp., Pittsburgh.

Revisions and additions to source term data for Westinghouse PWR plants are presented. The data cover gaseous releases from operating plants, tritium, reactor cooling system activity, steam generator tube leakage experience, and liquid waste processing system. (JWR)

23581 (WCAP-8498) INCORE POWER DISTRIBUTION DETERMINATION IN WESTINGHOUSE PRESSURIZED WATER REACTORS. Meyer, C. E.; Stover, R. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jul 1975. 36p. Westinghouse Electric Corp., Pittsburgh.

Determination of power distribution using the In-Core Instrumentation System is periodically performed in the Westinghouse Pressurized Water Reactor. The measurements taken are then normally compiled into useful information for the plant operation using digital computation techniques. The instrumentation system employed to take these measurements and INCORE code which is used to process the information obtained are described. (auth)

23582 REACTOR COOLANT PUMPS. Hursen, T. F.; Anthony, C. E. (Westinghouse Electric Corp., Cheswick, PA). pp 45-52 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Principal design and performance characteristics of current reactor coolant pumps and their successful application to pressurized water reactors for central power stations are described and discussed. The historical development of specific pump hardware that was required to meet developing reactor system requirements, particularly as related to increasing pump size, is provided as background material for a presentation of current system requirements followed by specific pump descriptions. A discussion

of the key developmental and test procedures is included with various characterizations of the major subassemblies. A brief discussion of pump operating experience is also included with supporting data and conclusions. (auth)

23583 ENERGY. Environmentalist Push Light Water Reactors Out to Sea. Engineer (London).; 240: No. 6224, 24-26(26 Jun 1975).

Planning for the project of floating a light water reactor power station 3 miles out to sea, by the Westinghouse Offshore Power Systems, has reached an advanced stage. The background to the project, the plans envisaged if the project is approved by the Federal Energy Administration, the view of the environmentalists, and the importance of the project to Britain are briefly discussed. (UK)

23584 CURRENT FROM THE NUCLEAR POWER PLANT "BRUNO LEUSCHNER" GREIFSWALD. Fischer, R.; Geisthardt, A. (VEB Kernkraftwerk Bruno Leuschner, Greifswald (German Democratic Republic)). Technik (Berlin).; 29: No. 5, 293-297 (1974). (In German).

The startup, coolant circuits, core, safety systems, and environmental aspects of the Greifswald nuclear power plant are described. Design and operational data are summarized. (INIS)

23585 FLOATING NUCLEAR ELECTRIC GENERATING PLANTS. Kehnemuyi, M. Journal of the Society for Underwater Technology; 1: No. 1, 23-27(Mar 1975).

It is stated that the floating nuclear plant concept consists of a nuclear electric generating plant of standardized design mounted on a platform, with the total complex manufactured in a central shipyard on an assembly line basis. The proposed design is presented under the following headings: manufacture; platform structures; nuclear plant (PWR); containment; fuel handling; auxiliary building; safeguards area; power generation plant; administration and service facilities; electrical systems; and other siting considerations. (UK)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 22074, 22809, 23681, 23958, 24029, and 24058.

23586 (CF-58-6-37) GAS-COOLED REACTOR COOLANT CHOICE. (Oak Ridge National Lab., Tenn. (USA)). 12 Jun 1958. 94p. Dep. NTIS $7.75.

Declassified Sep 1970.

A compilation of the technical information presently available which bears on the problem of selecting a coolant for the graphite moderated gas-cooled reactor is presented. Discussions are included on the question of helium containment and availability, the status of the technology on carbon dioxide-graphite reactions, the influence of coolant choice on power cost and the compatibility of carbon dioxide with various fuel cladding materials. (auth)

23587 (CONF-750908-2) EXPERIMENTAL AND ANALYTICAL RESULTS FOR A PRESTRESSED CONCRETE REACTOR VESSEL MODEL UNDER SIMULATED HTGR OPERATING CONDITIONS. Callahan, J. P.; Corum, J. M.; Whitman, G. D. (Oak Ridge National Lab., Tenn. (USA)). 1975. 13p. Dep. NTIS $4.00.

From 3rd international conference on structural mechanics in reactor technology; London, UK (1 Sep 1975).

Prestressed Concrete Reactor Vessels (PCRVs) are unique when compared with more traditional concrete structures because of the elevated operating temperatures employed and the thorough understanding of structural behavior required to assure safety. In the United States a comprehensive program for developing and improving PCRVs has been undertaken by the Oak Ridge National Laboratory. As part of this effort, analytical methods and concrete materials characterization data have been developed. By incorporating the resulting data into an appropriate analysis method, predictions can be made of the time-dependent behavior of PCRVs subjected to anticipated nuclear reactor operating conditions. The thermal cylinder experiment described was designed to provide the information required to assess the capability of analytical methods to predict the structural behavior of operating PCRVs. (auth)

23588 (EIR-283) VERIFICATION OF SUBCHANNEL ANALYSIS COMPUTER CODES BY FULL-SCALE EXPERIMENTS. Huggenberger, M.; Markoczy, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jun 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

Subchannel analysis thermohydraulic design computer codes have been developed at the Swiss Federal Institute for Reactor Research within the framework of a long-term research and development program in gas cooled reactor core heat transfer and fluid flow. In order to establish the accuracy and reliability of the codes within the parameter range of interest full-scale out-of-pile experiments have been carried out. The codes were verified by comparison of their predictions with the experimental results. A description of the experimental facility, the measurements, the computer codes, and the results of the comparison are presented. (auth)

23589 (GA-A-13528) PUBLIC SERVICE COMPANY OF COLORADO 330-MW(e) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period Ending June 30, 1975. (General Atomic Co., San Diego, Calif. (USA)). 31 Jul 1975. Contract AT(04-3)-633. 12p. Dep. NTIS $4.00.

The continuation of the research and development program for the Public Service Company of Colorado 330-MW(e) High-temperature Gas-cooled Reactor is described. The work reported includes studies of component development, such as auxiliary equipment and special tools, and nuclear analysis of the fuel cycle, fuel zoning, and power shaping. The fuel development and fuel element proof testing portions of the report include demonstration testing of the performance of test fuel elements by means of irradiation at expected operating temperatures and capsule irradiation tests of production fuel. Studies covering the components of the steam generator under operating conditions are included. Experimental procedures and results are discussed and, where appropriate, the data are presented in tables, graphs, and photographs. (auth)

23590 (GERHTR-99) SUMMARY OF THE LECTURES PRESENTED BY THE KFA JUELICH IN CONJUNCTION WITH THE INDUSTRIAL FIRMS CONCERNED ON THE SUBJECT CATEGORIES HTRB AND GCFR AT THE REACTOR CONFERENCE 1974 OF THE DEUTSCHES ATOMFORUM eV/KTG (BERLIN). Delle, W. (comp.). (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Feb 1974. Translation of KFA-IRW-IB-6/74. 110p. Dep. NTIS $5.45.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

The Institute for Reactor Materials deals in close contact with the HTRB Project and with industrial firms and other research establishments predominantly with material problems which arise during the development of HTR plants. Studies are made in this case of ceramic materials and components for the reactor core and also of metals for components of the gas loop for utilization of the reactor heat (NPW). The principal emphasis of the work is therefore placed on the field of fuel particles, fuel elements, graphite materials and highly refractory alloys. The work in the field of fuel particles for the reactor with a single-cycle helium turbine (HHT) is aimed principally at improving the fission product retention and reducing the rupture rate. The Central Division for Fuel Element and Irradiation Technology (ZBB), which has been split off from the IRW since January 1, 1974, covers in addition questions of the improvement of light water reactor (LWR) fuel elements and the irradiation behavior of fuel elements for gas-cooled fast breeders (GCFR). The Report contains contributions from the above fields of work, which were submitted to the Reactor Conference 1974 of the Deutsches Atomforum/KTG. (auth

23591 (ORNL-TM-4882) REVIEW OF HTGR COATED FUEL PARTICLE STABILITY. Morgan, M. T. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 29p. Dep. NTIS $4.00.

The stability of coated fuel particles in high-temperature, gas-cooled reactors as a function of burnup, fast-neutron fluence, irradiation time, and temperature is reviewed; the effect of coating design parameters was not considered. The purpose of the review is to establish limits of coated particle performance and, in particular, to validate diagrams in which coating failure during abnormal temperature excursions is plotted vs previous irradiation time. (auth)

23592 IMPROVEMENTS IN OR RELATING TO INTEGRAL-FUEL BLOCKS. Cunningham, C.; Simpkin, S. D. (to British Nuclear Design and Construction Ltd.). British Patent 1,384,617/B/. 19 Feb 1975. Filed date 30 Jun 1972. 5p.

Reference is made to fuel-containing moderator blocks for nuclear reactors and particularly for high temperature reactors. The object is to provide a fuel-containing moderator block with fuel-containing channels and coolant channels distributed in a pattern so as to allow improved temperature uniformity at the

edges and remote therefrom. Full geometrical details are given. (UK)

23593 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Cairns, W. J. (to British Nuclear Design and Construction Ltd.). British Patent 1,384,049/B/. 19 Feb 1975. Filed date 14 Jan 1971. 4p.

Reference is made to reactors incorporating coolant purification systems. Systems have been proposed, particularly for gaseous coolants such as He, in which the various components of the purification system are housed in individual pressure vessels located outside the main reactor pressure vessel, but such an arrangement is very expensive to provide and is bulky; furthermore, interconnections between the individual pressure vessels require high duty piping and seals of high integrity, and circulators are required for pumping fluid around the purification system. In the system described the purification system is located within chambers in the main pressure vessel. The reactor is preferably provided with a number of such chambers, so that one system at a time can be isolated from the reactor coolant circuit for maintenance and regeneration. The arrangement is especially suitable for a reactor having a number of small auxiliary boilers and turbo-generators in addition to a corresponding number of main boilers and turbo-generators, each boiler being located in a chamber within the main pressure vessel. All the chambers are substantially of the same size, those containing an auxiliary boiler having a purification system incorporated. (UK)

23594 BEHAVIOUR OF METHYL IODIDE IN THE WINDSCALE AGR. Hillary, J. J.; Taylor, J. C. (United Kingdom Atomic Energy Authority, Sellafield, Eng.). J. Br. Nucl. Energy Soc.; 14: No. 2, 159-165(Apr 1975).

Three experiments have been carried out in which labelled methyl iodide sources were injected into the Windscale AGR pressure circuit under different reactor temperature conditions, and the rate of removal of iodine from the gas was followed by a sampling program. At low temperatures the removal rate corresponded to a half-life of 30 min but at more elevated temperatures the half-life was 30 sec or less initially, increasing rapidly to produce eventually a steady iodine concentration in the gas. (auth)

23595 AGR PROGRAM. Halligey, F. J. (Atomic Power Construction Ltd., Dungeness, Eng.). S. Afr. Mech. Eng.; 24: No. 10, 250-267(Oct 1974).

A brief outline is presented of the highlights of AGR constructional and operational philosophies, and some of the AGR plant features are described. (DG)

23596 HTR AS A POWER SOURCE. Insch, G. M. (British Nuclear Design and Construction Ltd., Whetstone, Eng.). Chem. Eng. (London).; No. 296, 235-237(Apr 1975).

Development of gas-cooled reactors in the United Kingdom is reviewed. The design of a 1350 MW(e) HTR incorporating a multicavity concrete pressure vessel with boilers and circulators in pods in the vessel wall is described. Special features to which attention is drawn include several which are important in safety analysis, low heat-rejection, efficient use of a variety of fuel cycles, and convenience in operation and maintenance. (UK)

23597 HUNTERSTON "B" NUCLEAR POWER STATION. Vigilance; 3: No. 2, 15-18(1975).

The engineering design and construction of the Hunterston B Nuclear Power Station is considered with special reference to the survey and inspection of the pressurized components of the plant. The work involved in design, specifications, and inspection of the station is discussed. (UK)

23598 HTRS, ZINC AND ALUMINUM. Huwyler, S.; Seifritz, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). Nature (London).; 255: No. 5505, 188(15 May 1975).

It is suggested that the high temperature gas cooled reactor (HTR) could be used as a source of process heat in the Zn and Al making processes, as well as in steel making. In the case of Zn its oxide might conveniently be reduced using CH_4 or H_2, with an HTR providing the process heat, at temperatures well below 1000°C. Natural gas or CH_4 produced by coal gasification, again using HTR process heat, may be used for the reduction. The Zn metal produced may be used in the Al making process. (UK)

23599 HTR AS AN INDUSTRIAL HEAT SOURCE. Hosegood, S. B. (Organization for Economic Co-Operation and Development, Winfrith, Eng.). Chem. Eng. (London).; No. 296, 238-241(Apr 1975).

The basic characteristics of the HTR which enable it to achieve much higher coolant temperatures than alternative types of reactors are summarized. Potential applications of process steam are considered. Some of the problems to be overcome are discussed, and current international activities are briefly surveyed. (UK)

23600 OVERALL EFFICIENCIES FOR NUCLEAR HEAT UTILIZATION IN THE PRODUCTION OF HYDROGEN BY WATER DECOMPOSITION. Courvoisier, P.; Roth, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Recherche et Analyse); Lecoanet, A.; Pottier, J. (Gaz de France, 75 - Paris). pp 266-267 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The practical efficiency of water decomposition processes (electrochemical or thermochemical) is studied. (FR)

23601 MOLTEN SALT REACTORS FOR HIGH TEMPERATURES. Faugeras, P.; Lecoq, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif); Blum, J. M.; Grenon, M. (Compagnie de Produits Chimiques et Electrometallurgiques Pechiney-Ugine Kuhlmann, 75 - Paris (France)). pp 261-262 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The feasibility of a molten salt reactor working above 1000°C is conditioned by the behavior of the component materials. The CEA research program involves mechanical and corrosion testing of materials in salt at high temperature and the construction and exploitation of loops at high temperature. (FR)

23602 OPERATING EXPERIENCE WITH HIGH-TEMPERATURE NUCLEAR POWER PLANTS. Hantke, H. J. BBC-Nachr.; 57: No. 4, 208-215(1975). (In German).

The ever increasing power demand creates a number of problems which might be solved by the use of high-temperature nuclear power plants, two of which are described: the experimental nuclear power plant of the Arbeitsgemeinschaft Versuchsreaktor GmbH (AVR) and the Peach Bottom-1 reactor. Their safety and performance features are discussed in detail. (auth)

23603 HELIUM USAGE IN LARGE, HIGH TEMPERATURE-GAS COOLED REACTORS. Kuzmycz, G. (Gilbert Associates, Inc., Reading, PA). pp 157-175 of Applications of Cryogenic Technology. Vol. 6. Booth, S. H. (ed.). Flushing, NY; Scholium International Inc. (1974).

From national symposium and exhibition on applications of cryogenic technology; Los Angeles, California, USA (2 Oct 1973). See CONF-7310103-.

There are several advantages in using a gas in general, and helium in particular as a coolant for nuclear reactors. A gas coolant permits high operating temperatures at moderate pressures resulting in an optimization of pressure, temperature and flow-rate. Gaseous coolants restrict the possibility of a complete loss of coolant accident since they do not change phase. Helium is chemically inert, noncorrosive, absorbs essentially zero neutrinos, makes no contribution to the reactivity of the system, has a low pumping power index, and a high cooling efficiency index. In addition to being used as a coolant for High-Temperature Gas-Cooled Reactors, helium is also utilized for various other purposes. Helium is used to actuate the Reserve Shutdown System of the HTGR thereby introducing negative reactivity as a backup for the reactor scram system. The helium purification system is regenerated by purging with helium. The adsorber columns of the Radioactive Gas Recovery System are purged with helium. Helium is also used to purge and cool the fuel-handling equipment during refueling. (auth)

23604 FORT ST. VRAIN HIGH TEMPERATURE GAS-COOLED REACTOR. Walker, R. F. (Public Service Co. of Colorado, Denver). pp 176-189 of Applications of Cryogenic Technology. Vol. 6. Booth, S. H. (ed.). Flushing, NY; Scholium International Inc. (1974).

From national symposium and exhibition on applications of cryogenic technology; Los Angeles, California, USA (2 Oct 1973). See CONF-7310103-.

The construction, testing, and preliminary operating experience of the Fort St. Vrain Nuclear Generating Station are described. This station utilizes the advanced high-temperature gas-cooled reactor (HTGR) concept and is the first nuclear reactor system in the United States to use a prestressed concrete reactor vessel (PCRV). Helium is used as the primary coolant, and a nitrogen system provides refrigeration for the low temperature equipment of the helium purification system and for the moisture monitors in the primary coolant system. Design, construction and testing to date at this station have made a significant contribution to the

HTGR concept for central station electric generating plants to supply the increasing demands for electrical energy. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 23941 and 23959.

23605 (AECL-4920) EXPERIENCE WITH COOPERATIVE DEVELOPMENTS BY INDUSTRY AND THE AECL RESEARCH LABORATORIES. Banerjee, S.; Hart, R. G.; Fletcher, G. W.; Hart, A. E. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jan 1975. 17p. (CONF-7410134-1). Dep. NTIS (US Sales Only) $4.00. AECL $0.50.

From 24th Canadian chemical engineering conference; Ottawa, Ontario, Canada (22 Oct 1974).

A discussion is presented of AECL experience in cooperating with industry to develop nuclear components, instrumentation, fuel and specialized consulting and other services. Case histories and methods of industrial-research laboratory interaction which have proved successful and some problems encountered are discussed. (auth)

23606 COMMISSIONING OF PUMPS FOR CANDU-BLW REACTOR. Reid, J. A. (Canatom Ltd., Montreal, Quebec). pp 109-117 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The installation and commissioning through to operation of the 6 primary coolant pumps at the Atomic Energy of Canada Ltd. CANDU-BLW reactor at Gentilly, Quebec are described. The pumps are of the vertical shaft design each rated at 7700 IGPM at a total head of 708FT, driven by 1700HP-1788RPM electric motors. The design of the station is outlined to illustrate the function carried out by these pumps. The construction, assembly and installation of the pumps are covered to demonstrate the problems of building such pumps in a construction atmosphere against a schedule to the desired limits of quality control and ultimate reliability. The commissioning functions from completion of building up to start-up are outlined, and the essential auxiliary systems reviewed. Start-up procedures and initial running tests, which highlighted a defect in the main thrust unit bearings, are described. The run-up period enabled the basic vibration and running temperatures to be established. During the subsequent running period to full reactor power a further pump failure occurred when a shaft sheared, the causes of which are considered. (auth)

23607 CENTRALES NUCLEARES EN LA REPUBLICA ARGENTINA SU TECNOLOGIA Y SU IMPACTO REGIONAL. (Nuclear Power Plants in the Argentina Republic. Their Technology and Regional Impact). Buenos Aires; Comision Nacional de Energia Atomica (1974). 517p. (CNEA-TE-35/137; CONF-721242-2).

23608 STEAM GENERATING HEAVY WATER REACTOR. Dannatt, P. C. (Nuclear Power Group Ltd., Risley, Eng.). Chem. Eng. (London).; No. 296, 232-234(Apr 1975).

A description is given of the 660MW(e) commercial SGHWR design, which is a direct development of the 100MW(e) reactor at Winfrith, Parameters of the two are compared, and details are given of the fuel channels, calandria, coolant circuit, and emergency core cooling systems. Refueling is described, and a brief outline is given of the layout and containment. (UK)

23609 CALCULATION OF THE FAST NEUTRON FLUX INSIDE THE WALL OF THE KS-150 REACTOR VESSEL. Bergel'son, B. R.; Iofe, B. L.; Kobzarev, I. Yu. (Inst. of Theoretical and Experimental Physics, Moscow). Jad. Energ.; 21: No. 4, 151-160(Apr 1975). (In Russian).

The fast neutron flux (energies above 0.5 MeV) inside the wall of the KS-150 reactor vessel was calculated. The neutron transport through the heavy-water reflector was calculated by solving numerically the exact kinetic equation. The neutron density distribution inside the thermal shielding and the reactor vessel was found by solving the multigroup diffusion equation with effective diffusion lengths. From comparison with experimental values of permissible neutron integral fluxes inside the reactor vessel its life-time was estimated. (18 references) (auth)

23610 CANDU IN A WORLD PERSPECTIVE. Guard, R. (Canatom Ltd., Montreal). B. C. Prof. Eng.; 26: No. 3, 21-23 (Mar 1975).

A brief discussion is given of the CANDU type reactor in relation to competitive designs. Fuel cost and availability and capital cost are singled out for special treatment. Factors hindering the expansion of nuclear power are discussed. (CA)

23611 CONSTRUCTION ADVANCES AT GENTILLY 2. Mod. Power Eng.; 69: No. 5, 62-63(May 1975).

Gentilly-2, a 600 MW, CANDU-PHW type reactor, is estimated to cost $385 million. Several features which make this power plant unique are: the self-contained, complete, one-unit modular design; a half million gallon dousing tank which will eliminate the need for vacuum buildings; four 200-ton boilers arranged in two independent banks; and the use of slipforming as the method of erecting the perimeter wall for the reactor building. Construction is expected to be complete and the reactor in service in 1979. (CA)

23612 PERFORMANCE AND RELIABILITY OF PRIMARY CIRCUIT COMPONENTS IN CANDU REACTORS. Ross-Ross, P. A.; Dixon, D. F.; Metcalfe, R. (Atomic Energy of Canada Ltd., Chalk River, Ontario); Adams, E. J. (Canadian General Electric Co. Ltd., Peterborough, Ontario). pp 208-210 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Quality control, performance and reliability of the pressure tubes, steam generators, pumps, valves and fuel handling system in Candu reactors are reviewed. (FR)

Power Reactors, Breeding

Refer also to abstracts 22945, 22947, 23590, 23915, 23916, 23918, 23920–23923, 23925, 23930, 23931, 23936, 23955, 23963, 23965, and 24027.

23613 (ANL-CT-75-40) DYNAMIC RESPONSE OF TWO PARALLEL CIRCULAR CYLINDERS IN A LIQUID. Chen, S. S. (Argonne National Lab., Ill. (USA)). May 1975. Contract W-31-109-eng-38. 35p. Dep. NTIS $4.75.

The problem of two parallel circular cylinders vibrating in a liquid is studied analytically. The equations of motion including fluid coupling are formulated using the added mass concept. A closed form solution and an approximate solution are obtained for free vibration. The steady state responses of two cylinders subjected to harmonic excitations are presented. The results illustrate the significance of the interaction of two structures in a liquid. (auth)

23614 (ANL-RDP-40) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, MAY 1975. (Argonne National Lab., Ill. (USA)). 30 Jul 1975. Contract W-31-109-Eng-38. 220p. AT.

This progress report summarizes the Argonne National Laboratory work performed for the Reactor Development Program during May 1975 in the following research and development areas: Experimental Breeder Reactor No. II (EBR-II), Hot Fuel Examination Facility, LMFBR Design Support, Instrumentation and Control, Fuels and Materials Development, Reactor Physics, Reactor Safety, and Other Fast Breeder Reactors (GCFR). (auth)

23615 (BNWL-B-85) PRE-EXPERIMENT ANALYSIS FOR MSBR-1 EXPERIMENT. Lippincott, E. P.; Davis, E. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1971. Contract AT(45-1)-1830. 18p. Dep. NTIS $4.00.

A reactor lattice physics experiment planned for the High Temperature Lattice Test Reactor in support of the Molten Salt Breeder Reactor program is analyzed. (JWR)

23616 (CONF-750617-20) SIMPLIFIED INELASTIC (PLASTIC AND CREEP) ANALYSIS OF PIPE ELBOWS SUBJECTED TO INPLANE AND OUT-of-PLANE BENDING. Mello, R. M.; Scheller, J. D. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Dec 1974. Contract AT(11-1)-3045. 38p. Dep. NTIS $5.00.

From second ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

The inelastic analysis of elbows typical of use in Liquid Metal Fast Reactor piping systems is described. Detailed information on stresses, plastic and creep strains, and deformations throughout the elbow bodies resulting from elastic/plastic, elastic/plastic/creep, and elastic/plastic-creep/relaxation material behavior was obtained for the cases of applied inplane and out-of-plane moment loading on the elbows. Some conclusions are made concerning the nature of the resulting stresses in the elbows. The

simplified pipe-bend element in the MARC nonlinear finite element program is used as the analytical tool. This element permits nonlinear analysis of piping elbows and pipeline systems at realistic cost. (auth)

23617 (CONF-750911-1) MECHANICAL AND PHYSICAL PROPERTIES OF 2¼ Cr–1 Mo STEEL IN SUPPORT OF CRBRP STEAM GENERATOR DESIGN. Brinkman, C. R.; Williams, R. K.; Klueh, R. L.; Hebble, T. L. (Oak Ridge National Lab., Tenn. (USA)). 1975. 43p. Dep. NTIS $5.25.

From international conference on materials for nuclear steam generators; Gatlinburg, Tennessee, USA (9 Sep 1975).

Mechanical and physical property tests on annealed 2¼ Cr–1 Mo steel were conducted in an effort to define behavior in support of the design of the Clinch River Breeder Reactor Plant (CRBRP) steam generator design. Interim empirical expressions and/or data are reported from the results of tensile, creep, fatigue, creep-fatigue, subcritical crack growth, thermal conductivity, thermal diffusivity, and thermal expansion tests and analysis. These expressions cover behavior, where appropriate, over a range of temperatures from 25 to as high as 700°C. Comparisons between thermal conductivity and diffusivity values and those found in the American Society of Mechanical Engineers (ASME) Code indicated that the new values were significantly higher than those found presently in the Code. The importance and complexity of obtaining valid mechanical and physical properties for the Clinch River Breeder Reactor Plant (CRBRP) steam generator are discussed. (auth)

23618 (CONF-750916-1) NUCLEAR WELDING, APPLICATION FOR AN LMFBR. Patriarca, P.; Goodwin, G. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 38p. Dep. NTIS $5.00.

From 4th army materials technology conference, advances in joining technology; Boston, Massachusetts, USA (16 Sep 1975).

Fabrication of an LMFBR system is discussed, with emphasis on areas where joint welding innovations have been introduced. Each major component of the system, including reactor vessel, intermediate heat exchanger, steam generator, and sodium-containment piping, is treated separately. Development of special filler metals to avoid the low elevated-temperature creep ductility obtained with conventional austenitic stainless steel weldments is reported. Bore-side welding of steam generator tube-to-tubesheet joints with and without filler metal is desirable to improve inspectability and eliminate the crevice inherent with face-side weld design, thus minimizing corrosion problems. Automated welding methods for sodium-containment piping are summarized which minimize and control distortion and ensure welds of high integrity. Selection of materials for the various components is discussed for plants presently under construction, and materials predictions are made for future concepts. (auth)

23619 (EIR-193) POST IRRADIATION EXAMINATION OF THE FILOS 04 RIG CONTAINING TWO INSTRUMENTED (U,Pu)C SPHERE-PAC FUEL PINS IRRADIATED IN THE FILOS LOOP OF THE SAPHIR REACTOR AT EIR WUERENLINGEN. Smith, L.; Leute, H.; Peddicord, K.; Buetzer, P.; Buergisser, B. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). May 1975. 58p. Dep. NTIS (US Sales Only) $6.00.

The results of the post irradiation examination of two fuel pins irradiated in the SAPHIR reactor at Wuerenlingen are reported. The fuel for both pins was uranium–plutonium monocarbide in the form of spheres vibrationally packed into AISI Type 316 L stainless steel pins to a smeared density of approximately 77% of theoretical. Mean burnup achieved in each pin was approximately 12,000 MWD/Te of fuel. Although fuel center temperatures have been calculated as high as 1250° with short term peaking to 1400°C, no fuel sintering was observed. It is likely that both pins leaked in pile but the failures were attributed to pin instrumentation and not to fuel clad weaknesses. (auth)

23620 (HEDL-SA-981) POSTULATED ACCIDENT CONDITIONS FOR AIR CLEANING SYSTEMS AND RADIOLOGICAL DOSE ASSESSMENTS FOR CONTAINMENT OPTIONS. Hilliard, R. K.; Postma, A. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract AT(45-1)-2170. 43p. (CONF-750719-4). Dep. NTIS $5.25.

From safety technology meeting on radiological consequence assessment; Canoga Park, California, USA (29 Jul 1975).

Ambient conditions and performance requirements for emergency air cleaning systems applicable to commercial LMFBR plants were studied. The focus of this study centered on aerosol removal under hypothetical core disruptive accident conditions. Effort completed includes a review of air cleaning systems related to LMFBR plants, selection of three reference containment system designs, postulation of the EACS design basis accident (EACS-DBA), analysis of thermal conditions resulting from the DBA, analysis of aerosol transport behavior following the DBA, and an estimate of bone dose at the site boundary for each of the reference plant designs. Reference plant concepts were a single containment system (e.g., FFTF), a double containment system (e.g., CRBRP with closed head compartment), and a containment-confinement design in which an inerted, sealed primary volume was located within a ventilated building whose exhaust was filtered. The reference design basis accident selected here involved release to the inner containment system of 1 percent of non-volatile solids and plutonium, 25 percent of core halogens, 25 percent of core volatile solids, 100 percent of core noble gases, 68 lbs of sodium vapor and 5000 lbs of liquid sodium. 13 references. (auth)

23621 (HEDL-SA-982) EMERGENCY AIR CLEANING SYSTEM DEVELOPMENT FOR LMFBR CONTAINMENTS. McCormack, J. D.; Hilliard, R. K.; Postma, A. K.; Muhlestein, L. D. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract AT(45-1)-2170. 24p. (CONF-750719-1). Dep. NTIS $4.25.

From safety technology meeting on radiological consequence assessment; Canoga Park, California, USA (29 Jul 1975).

Criteria for evaluating the various types of Emergency Air Cleaning Systems which may be used in LMFBR plants have been established for both single containment and containment-confinement arrangements. These two plant arrangements have quite different air cleaning requirements for postulated design base accident conditions. Work is currently in progress to select from a list of candidate air cleaning systems those which best meet the criteria requirements. By means of a weighted rating system, areas of strength or weakness can be found and the conceptual system design then optimized. The final system arrangements will be ranked and several of the most promising systems selected for large-scale tests in the former CSE vessel at Hanford. 8 references. (auth)

23622 (HEDL-SA-984) EXPERIMENTAL PLANS FOR AEROSOL BEHAVIOR TESTS IN A LARGE VESSEL. Hilliard, R. K.; Muhlestein, L. D.; McCormack, J. D.; Postma, A. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract AT(45-1)-2170. 13p. (CONF-750719-3). Dep. NTIS $4.00.

From safety technology meeting on radiological consequence assessment; Canoga Park, California, USA (29 Jul 1975).

Four tests in a large containment vessel (67 feet high by 25 feet in diameter) are currently under consideration in the HEDL Emergency Air Cleaning System development program. These tests are aimed primarily at developing baseline information on aerosol behavior for use in large-scale tests of emergency air cleaning systems. Experimental data will be obtained to permit comparison of results with predictions based on computer models such as HAA-3B. Test AB-1 will essentially be a size scale-up of earlier tests conducted at Atomics International which provided the basis for the HAA-3B code. Test AB-2 will duplicate test AB-1 except that moisture (to simulate water released from heated concrete) will be added to the containment atmosphere. Test AB-3 will be similar to test AB-1, but will use a sodium spray fire rather than pool fire as an aerosol source. Test AB-4 will use UO_2 and I aerosols and vapor as well as sodium oxide. (auth)

23623 (JUL-11(Bd.1), pp 27-46) DETERMINATION OF ^{89}Sr AND ^{90}Sr IN THE DEVELOPMENT OF HTR-FUEL ELEMENTS AND OF IODINE IN SPREADING EXPERIMENTS. Stoeppler, M.; May, K.; Matthes, W. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

9 figs.; 19 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. I. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

A method was developed to determine the β-emitting nuclides ^{89}Sr and ^{90}Sr in the graphite cladding of irradiated spherical HTR fuel elements. Due to constant adaptation to the present state of development of these fuel elements and to extending to a routine method, the total error is below 5%. After a pyrolytic treatment of the graphite containing the fission products, the residue is made up to a solution and subjected to ion exchange separation where the Sr nuclides are separated from the rest of the fission products. Decontamination factors between 10^3 and 2×10^4 were determined for the most important fission products. In a second part of the work, a report is given on experiments for the diffusion and deposition of iodine in the environment of nuclear plants. The Sandell-Kolthoff reaction was modified here to a trace analysis method for air and plants. (GE)

23624 (JUL-11(Bd.1), pp 47-69) DETERMINATION OF RADIONUCLIDES IN THE PRIMARY COOLANT OF SODIUM-

COOLED NUCLEAR REACTORS. Stamm, H. H. Nov 1974. (In German).

From workshop on modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

11 figs.; 6 tabs.; 11 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. I. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

There are long-lived radionuclides in addition to the Na-24 activity produced in the primary cooling circuit during the operation of sodium-cooled reactors. These are: (1) activated impurities in the coolant itself, (2) activated corrosion products from materials of the plant, and (3) fission products from defective fuel elements. By means of activation analysis, impurities in the ppm region in commercial sodium can be well determined. The completely non-uniform distribution of these impurities found in a sample shows the importance of taking a sample for the investigation of coolant contamination. A special device was developed for this which is brought to the main Na pipe of the cooling circuit by a 'by-pass' and thus makes the removal of a representative Na sample possible. The material of the sample removing container is also important. The deciding factors for the share of corrosion products in the coolant are temperature, flow rate and oxygen content. The transport of activated corrosion products through sodium can be quite considerable as shown by calculations. The most important factors in the contamination of the system are the cladding tube defects which not only lead to the release of fission products into the coolant but also of fuel particles. Some experiences gained at the KNK reactor in the Nuclear Research Centre, Karlsruhe are given. (GE)

23625 (KFK-1274/4) FAST BREEDER PROJECT. Fourth Quarterly Report, 1974. Hueper, R. (comp.). (Kernforschungszentrum Karlsruhe (F. R. Germany)). May 1975. 164p. (In German). (EUR-5201d). Dep. NTIS (US Sales Only) $11.25.

A description is given of SNR fuel pin development work performed in the 4th quarter of 1974 at Gesellschaft für Kernforschung mbH Karlsruhe within the framework of the Fast Breeder Project. (auth)

23626 (KFK-1886) FUEL PIN IRRADIATION TEST WITH INTEGRATED VARIATION OF THE FUEL DENSITY: FR 2 CAPSULE GROUP 5a. Kummerer, K.; Weimar, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). May 1975. 199p. (In German). Dep. NTIS (US Sales Only) $13.00.

The irradiation was performed in 3 Na/PbBi-capsules, each loaded with 3 pin specimens, at linear rod powers of about 500 W/cm, clad surface temperatures of about 600 C up to the 3 burnup stages 6, 17 and 47 MWd/kg M. The 80 mm long fuel column in every pin was composed by 84, 87, 90 and 93% th.D. fuel portions. The SS cladded pins had an outer diameter of 7 mm. Two pins out of the 9 irradiated were ruptured for unknown reasons. Included are the objectives of the experiment, the detailed description of design, specification and fabrication of the pin specimens, the irradiation history, and the post irradiation examination. The final evaluation demonstrates that structural changes in the fuel are systematically related to the original fuel density. (auth)

23627 (KFK-1965) CALCULATION OF THE VARIATION IN STOICHIOMETRY AS A FUNCTION OF BURNUP AND OF THE RADIAL OXYGEN DISTRIBUTION IN HYPOSTOICHIOMETRIC MIXED OXIDE FUEL PINS. Bober, M.; Schumacher, G. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). May 1975. 34p. (In German). Dep. NTIS (US Sales Only) $4.75.

A description is presented of a calculation of the variation in stoichiometry as a function of burnup including the effects of the neutron flux spectrum, the isotopic composition of actinides, the concentration of plutonium oxide, and the initial fuel stoichiometry. The effects are calculated for fuel pins of an irradiation experiment in the RAPSODIE reactor and for the Mark Ia core of the SNR-300. The largest differences in the effects occur both when the degree of enrichment of U-235 in uranium and the concentration of plutonium are changed. Their increase causes a reduction of the variation in stoichiometry. The radial oxygen distribution is calculated for steady state thermal diffusion in the solid state. It is shown that transport via the gas phase can be neglected in practice. The quantities of influence are the heat of transport of oxygen thermal diffusion, the temperature gradient, and the radial average of the O/(U + Pu) ratio. The dependence of the heat of transport on stoichiometry is considered in the calculation of the radial oxygen distribution. It reveals the radial O/(U + Pu)-profile is not as steep as expected from earlier calculations in which the dependence on stoichiometry was not taken into account. (auth)

23628 (KFK-2090) PERIPHERAL PROGRAM OF THE COBRA-THEDYBER PROGRAM USED IN PERFORMING A PARAMETER STUDY. Hilka, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorbauelemente). Mar 1975. 38p. (In German). Dep. NTIS (US Sales Only) $5.00.

Peripheral programs are described which have been constructed to carry out a parameter study as faultless and quickly as possible, using the COBRA-THEDYBER program for the determination of the efficiency of a steam cooled fast breeder reactor taking into account different coolant circuit arrangements and parameter variations. The programs largely assume the organization of the parameters in the process of data input as well as the clear representation of results in the form of tables and graphical plots. (auth)

23629 (KFK-2117) ULTRASONIC SWEEP ARM FOR LMFBR. Rohrbacher, H. A.; Bartholomay, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). May 1975. 25p. (In German). Dep. NTIS (US Sales Only) $4.25.

A description is given of a monitoring and testing device to be applied in conjunction with components in a sodium environment. In the method outlined, ultrasonic pulses are used which are emitted into the sodium plenum of fast breeder reactors by newly developed high temperature transducers. The basic work was conducted under out-of-pile conditions in a sodium tank of the sodium tank facility of the Karlsruhe Institute for Reactor Development. The sensor development, which preceded this phase, resulted in the use of soldered lithium niobate crystals whose operating characteristics were improved by the preliminary treatment outlined. Special materials and techniques suitable for sensor fabrication are proposed. An alternative to soldering is suggested for contacting the crystals with their diaphragms, i.e., a contact pressure concept for the range of application up to 2 MHz. (auth)

23630 (KFK-2132) TRANSFER CELL AND CORE-ELEMENT STORAGE-FACILITY FOR THE SNR 2. Zimmerman, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Reaktorbetrieb und Technik). May 1975. 55p. (In German). Dep. NTIS (US Sales Only) $5.75.

Following a short survey of the development and state of the art of fuel handling systems, the concept of fuel element handling chosen for SNR 2 is described briefly. The transfer cell fuel handling facility connecting the reactor with the sodium cooled fuel element storage is described in detail and first design features are given. The fuel element storage is examined, and preliminary estimates are made of the size and the required cooling capacity. (auth)

23631 (WARD-5558) SEISMIC DESIGN CRITERIA FOR THE CLINCH RIVER BREEDER REACTOR PLANT. Morrone, A.; Bitner, J. L.; Sigal, G. B. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1975. 34p. (CONF-750617-19). Dep. NTIS $4.75.

From 2nd ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

The general criteria for seismic resistant design for structures, systems and components of the Clinch River Breeder Reactor Plant (CRBRP) are presented and discussed. Site dependency of the maximum ground accelerations for the Operating Basis Earthquake and the Safe Shutdown Earthquake is described from the viewpoint of historical records and geological and seismological studies for the CRBRP site. The respective ground response spectra are derived by normalization of the latest AEC Regulatory standard shapes to these maximum ground accelerations. Modeling and analytical techniques and requirements are given. In addition, loading conditions and categories, loading combinations, earthquake direction effects and allowable damping values are defined. A discussion of the testing criteria which considers both single and multiple frequency test motions, and basic test procedures for single frequency sine beat testing is presented. (auth)

23632 INDUSTRY SUPPORT: THE KEY TO NATIONAL ACCEPTANCE OF THE CLINCH RIVER BREEDER REACTOR. Lewis, F. W. (Middle South Utilities, Inc., New Orleans). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

The role of electric utilities in communicating breeder reactor information to the public in order to overcome breeder reactor public-acceptance problems is examined. A description is given of informational material available to utilities affiliated with the Breeder Reactor Corporation. (JG)

23633 [STATUS OF THE CLINCH RIVER REACTOR]. Van Nort, P. S. pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

A brief discussion of the nuclear fuel cycle and projected U. S. uranium reserves is presented, and the role of the breeder reactor in meeting future energy needs is emphasized. A brief status report on the Clinch River Breeder Reactor includes descriptions of the reactor site, plant design, plant schedule, and project costs. (DG)

23634 SPECIAL REQUIREMENTS FOR PUMPS FOR SODIUM COOLED FAST REACTORS. Gibbs, K. P.; Oliver, A. G. (Central Electricity Generating Board, Cheltenham, Eng.). pp 119-124 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

An explanation is given of how breeding improves the utilization of uranium resources and why fast reactors are better breeders than thermal reactors. High power densities in the reactor core improve breeding performance but demand an efficient coolant such as sodium. The advantages and disadvantages of sodium are given, with particular reference to the need for a secondary coolant circuit between the reactor and boilers. Alternative styles that have been adopted for the primary circuit are described and illustrated. The general problems arising from running the plant in such an arduous chemical and thermal environment, often radioactivity contaminated, are reviewed. Examples are given of the hydraulic performance required from pumps in contemporary and future reactors. Off-design point performance is also important: the safety of the reactor depends on stable and sufficient flows from a pump against a wide range of steady and transient heads. The acoustic effects of cavitation or erosion may be more limiting than critical cavitation. The relationship is established of pump noise with boiling noise detection and acoustic excitation of reactor components. The pumps need to be securely sealed and fixed in place as they penetrate the containments of the reactor and secondary sodium circuits. Measures to achieve high reactor availability are described and justified by reference to high outage penalties. Maintenance is made difficult by contamination from sodium and radioactivity; comprehensive functional testing of a maintained pump will be needed before it can return to service. The importance of the pump manufacturer's and the reactor designer's thorough understanding of each other's problems is emphasised. (auth)

23635 SOME SPECIAL SEALS FOR SODIUM COOLED NUCLEAR POWER PLANT. Cross, R. A. (Cross Manufacturing Co., Ltd., Bath, Eng.). pp 125-132 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The use of sodium in nuclear power plant has produced many new sealing problems. The design and manufacture of some seals for this environment are described. They include small piston ring type seals made in "exotic" alloys up to diameters of 2000 mm. Some of the seals have also served as bearings, and this has given rise to particular designs for the purpose. The ways in which some of the problems of manufacture were overcome are described, and some methods by which savings could be made for the next generation of sodium cooled apparatus are suggested. (auth)

23636 ELECTROMAGNETIC PUMPS FOR SODIUM COOLED REACTORS. Orszak, P. (General Electric Co., Reactor Equipment Ltd., Whetstone, Eng.). pp 133-139 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Comparisons are made between the types of electro-magnetic pumps commonly used for handling liquid sodium and potassium, in terms of efficiency, control, and specific characteristics. Experience on the main circulating pumps in Dounreay Fast Reactor is detailed, and some special e.m. pumps used in the Prototype Fast Reactor are described. The possibility of extending the use of e.m. pumps to the circulation of primary and secondary coolant on commercial power reactors is discussed. (auth)

23637 LIQUID SODIUM ELECTRO-TECHNOLOGY. Davidson, D. F.; Thatcher, G. (UKAEA Reactor Group, Risley, Eng.). pp 141-148 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The good electrical conductivity of liquid metals, and particularly that of sodium, gives rise to the possibility of pumping or flow control by electromagnetic means. A number of unconventional methods of achieving this are reviewed with the object of stimulating interest in a subject which could possibly provide solutions to difficult problems in future reactor systems. (auth)

23638 OPERATING EXPERIENCES WITH THE PROTOTYPE 0.45 m^3/s SODIUM PUMP. Delves, P. H. (UKAEA Reactor Group, Risley, Eng.); Seed, G. pp 149-163 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The original development of a centrifugal circulating pump for the British sodium cooled Prototype Fast Reactor is described. No previous experience existed in the UK on a comparable scale, the previous phase of reactor development having been the Dounreay Fast Reactor using sodium-potassium coolant, circulated by multiple electro-magnetic pumps. A description is given of the design features together with the test program carried out on the prototype 0.45 m^3/s capacity pump. The results are discussed, particularly those concerning the validity of modeling and scaling and the importance of cavitation phenomena. (auth)

23639 CENTRIFUGAL SODIUM PUMPS FOR COMMERCIAL FAST REACTORS. Perrett, R. J. (General Electric Co., Reactor Equipment Ltd., Whetstone, Eng.); Seed, G. pp 165-171 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

A description is given of the design requirements of large primary coolant circulating pumps for sodium cooled fast reactors and of the special problems they present to the pump designer. Much of the discussion is based upon the experience gained with the supply of pumps for the PFR at Dounreay. Particular features proposed to meet the special needs of the CFR system are highlighted. Emphasis is placed on measures to ensure minimum acoustic outputs from the pump in the audio and ultrasonic frequency ranges. The importance of designing for safety, reliability, and minimum outage for maintenance is also emphasized. (auth)

23640 DESIGN, TESTING, AND COMMISSIONING OF SODIUM PUMPS FOR THE 600 MW(T) PROTOTYPE FAST REACTOR. Seed, G. (Nuclear Power Group Ltd., Risley, Eng.); Bowles, L. F.; MacLeod, I. D. pp 173-185 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The special design requirements of the PFR pumps are described. Particular attention is given to cavitation and acoustic performance requirements. The choice of hydraulic components, i.e. impeller and diffuser, is outlined, and the model development program and full scale works testing in water, with particular reference to acoustic behaviour, is described. Site commissioning of a secondary pump in water is discussed. Acoustic performance of the circuit and pump is discussed, and comparisons are made with model and works testing. Commissioning of the primary pumps in sodium is described, and acoustic performance in sodium is compared with the performance as measured during the works testing. Early commissioning faults are described. (auth)

23641 VIBRATIONAL RESPONSE CHARACTERISTICS OF A DESIGN FOR THE SODIUM PUMPS OF THE COMMERCIAL FAST REACTOR. Ramsden, J. N.; Ritchie, G. S.; Gupta, S. S. (General Electric Co., Power Engineering Ltd., Whetstone, Eng.). pp 187-196 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Analytical and computer techniques developed for the prediction of the whirling response of a flexible shaft in a resonance-prone structure have been applied to the prediction of the dynamic unbalance response of a design of sodium pump for the commercial fast reactor. The design features of interest from the dynamic point of view are that the pump incorporates a long hollow drive shaft carried vertically in widely spaced journal bearings within a cylindrical cantilevered casing, and having the interspace between shaft and casing partially filled with molten sodium. It was therefore necessary not only to model the hydrodynamic bearing behavior, gyroscopic couples, shaft and structure damping, and other standard features relevant to whirling analysis, but also to incorporate the dynamic effects of the highly turbulent rotating sodium occupying the interspace. To deal with these a small perturbation analysis of the turbulent mean flow was developed and used to predict rotor and stator reaction forces consequent upon small radial accelerations, velocities, and displacements

of the components. These force derivatives were calculated at points along the machine which aligned with chosen vibrational degrees-of-freedom, thus enabling them to be incorporated in the matrix equations of motion. Calculations were made with the machine flooded and dry. In both cases the response pattern consisted of a lower frequency mode involving a flexural vibration of the casing with a higher frequency mode representing flexural vibration of the shaft. It was observed that whereas the frequency of the casing mode was reduced on immersion in sodium, the shaft mode was unchanged. The lack of influence of immersion forces on the rotor flexural critical speed is discussed in some detail. (auth)

23642 DEVELOPMENT, DESIGN, CONSTRUCTION, AND FULL SCALE SODIUM TESTING OF A PROTOTYPE SODIUM PUMP FOR A LMFBR-POWER PLANT. Fakkel, R. H.; Hoornweg, C. J.; Mendte, W. K.; Jansing, M.; Lameris, H. J.; Vroom, J. P.; Heslefeld, M. H. (Neratoon N. V., Hague, Netherlands). pp 197-205 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Progress on the joint activities of the Benelux countries and Western Germany in the development, design, and manufacture of a prototype Na pump for the 300 MW(e) nuclear reactor SNR-300 is described. After a summary of the objectives of the program details are given of the following:- the 230 m^3/h pump for the test rig at Apeldoorn which is for investigating Na technology and materials testing; the 5000 m^3/h Na pump for SNR-300; testing of the 5000 m^3/h pump in water and in Na. The tests in Na were conducted at the A. P. B. test facility at Bensberg and were designed to examine the hydraulic behavior of the pump, low speed performance, thermal shock behavior, cavitation measurements, speed control, coast down curves, gas leakage, and dismounting of the pump. (UK)

23643 SNECMA-BERGERON SODIUM PUMPS DEVELOPMENT STAGE SEEN IN THE LIGHT OF THE PHENIX EXPERIMENT. Guer, M. (Societe d'Exploitation des Materiels Hispano-Suiza, Bois, Colombas, France); Raczynski, W.; Keyser, G.; Roumailhac, J. pp 207-214 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Development work on sodium pumps manufactured by SNECMA in cooperation with the CEA and BERGERON Company has recently been highlighted with the coming into operation of the primary and secondary pumps in Phenix reactor. The most significant facts of the Rapsodie experiment, and the experience drawn from it are reported. A description is given of the particular problems created by the use of pumps in an integrated reactor and of the answers to these problems. (auth)

23644 DEVELOPMENT OF MECHANICAL SODIUM PUMP. Ojiri, Y. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki, Japan); Suzuki, A.; Ito, Y.; Sakamoto, S. pp 215-217 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

The mock-up pumps for the primary coolant system of Joyo are described. The Na pump test loop is shown and the results of tests on the performance and continuous operation are described and compared with their characteristics in water. Scaling up from a capacity of 21 m^3/min in Joyo to that of 88 m^3/min in Monju is planned. Various problems and related research in the development of large size Na pumps are described. They relate to the manufacture of Monju pumps but are considered for the most part applicable to succeeding scale-ups. (UK)

23645 WAITING FOR THE BREEDER. Manne, A. S. (International Inst. for Applied Systems Analysis, Laxenburg, Austria). Review of Economic Studies; 47-65(1974).

Mention is made of the exhaustion of natural resources for energy production and the plausible contenders for large-scale future supplies of energy. Emphasis is placed on one aspect of the energy problem—the race between the development of breeder fission and the exhaustion of low-cost natural uranium resources. Sequential probabilistic linear programming is employed to calculate optimal electricity plant-mix decisions during the decade of the 1980s—give the uncertainty on the date of availability of the breeder. The model allows for the possibility that future uranium resource scarcities will lead to an increase in electricity prices and hence a reduction in the projected demands. (UK)

23646 NUCLEAR REACTOR TOP CLOSURE. Dumayne, R. (to Commissariat a l'Energie Atomique). Canadian Patent 968,074. 20 May 1975. 16p.

The device is primarily intended for use in fast reactors and comprises a first plug which is centered on the axis of the reactor core, a second rotating plug mounted eccentrically with respect to the axis of the first plug and a third plug mounted eccentrically with respect to the axis of the second plug, the eccentric displacement of the second plug with respect to the first being equal to the eccentric displacement of the third plug with respect to the second. Openings are formed in the second and third plugs in order to provide access to the interior of the reactor containment vessel and the second plug is fitted with a fourth rotating plug which is mounted eccentrically with respect to the axis of the second plug, an opening being also formed in the fourth plug in order to provide access to the interior of the containment vessel. (CA)

23647 EXPERIENCE IN COMMISSIONING WORKS AND ENERGETIC START-UP OF THE BN-350 REACTOR. Lejpunskij, A. I.; Mitenkov, F. M.; Orlov, V. V.; Yurchenko, D. S.; Shiryaev, V. I.; Arkhipov, V. M.; Bagdasarov, Yu. E.; Baklushin, R. P.; Blagovolin, S. M.; Vasilenko, K. T. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Kernenergie; 17: No. 12, 367-372(1974). (In German).

The start-up of the first nuclear power plant provided with a fast reactor of the BN-350 type was at Shevchenko on July 16, 1973. After achieving its nominal thermal power of 1000 MW the reactor will yield an electrical power of 150 MW and will produce 120,000 m^3 of fresh water per day. The main stages of its erection and start-up are described. The experience gathered during preparation and start-up of the coolant loops is presented. The results of studies of the dynamic characteristics are discussed. (INIS)

23648 URANIUM CONSERVATION AND THE ROLE OF THE GAS COOLED FAST BREEDER REACTOR. Vaughan, R. D. J. Br. Nucl. Energy Soc.; 14: No. 2, 105-115(Apr 1975).

From meeting of the British Nuclear Energy Society; London, Eng. (23 Jan 1975).

The efficient use of the world's limited uranium resources are discussed. Low grade U ores used for thermal reactor fuels require a significant amount of energy for mining and milling, and it is argued that an early introduction of breeder reactors into the West European nuclear program is essential to prevent rapid depletion of these ores. The gas cooled fast reactor meets the criteria of highest possible breeding capability, commercial attractiveness, and safety. The main features of the 120 MW(e) reactor design of the European GBR association are discussed. Main performance parameters and details of the reactor, fuel assembly, emergency cooling systems, and safety features are given. Costs are briefly considered. Proposals for a 600 MW(e) demonstration plant are discussed. The ways in which the fast breeder may provide process heat are examined. It is concluded that delay in introducing breeders will result in a shortfall of the total nuclear program and high generation costs. The gas-cooled fast breeder offers a good prospect of achieving the necessary breeding performance. (UK)

23649 EXTRACTS FROM AN ADDRESS TO THE BRITISH NUCLEAR ENERGY SOCIETY. Vaughan, R. D. (Nuclear Power Group Ltd., Risley, Eng.). Energy Dig. (London).; 4: No. 2, 4-11(Mar 1975).

The subject is treated under the following headings: introductory summary of global energy consumption and reserves; the role of breeder reactors (world uranium reserves and economics); fuel cycle options for reactors burning U 233, U 235, Pu 239; main features of the (helium) gas-cooled breeder; reactor plant; fuel assembly; emergency heat removal and safety features; economics; development status; and breeders in the long term. (UK)

23650 PROBE APPARATUS FOR NUCLEAR REACTORS. Hickson, M. R. (to Clarke-Chapman Ltd.). British Patent 1,384,565/B/. 19 Feb 1975. Filed Date 8 May 1972. 5p.

The apparatus described comprises a U-shaped guide that guides a flexible member extending around the curved base of the guide and having spaced rollers that engage the guide. Such apparatus is particularly applicable to reactors in which the core and the coolant are contained in a primary vessel and where all servicing and control facilities are accessible at the top of the vessel; a Na-cooled fast reactor is an example. The apparatus enables the core to be probed from below, whilst the operating means is accessible at the top of the primary vessel. The flexible member may comprise an elongated strip. (UK)

23651 QUALITY MANAGEMENT IN AN INTERNATIONAL NUCLEAR POWER PLANT PROJECT. Brion, J.; Crustin, J. (Societe Belge pour l'Industrie Nucleaire, Brussels). pp 213-215 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

SNR (Schneller Natriumgekuehlter Reaktor) is the fast reactor power plant being erected at Kalkar, Federal German Republic. Quality management in this project is a contractual obligation. Quality management is subdivided into quality engineering, a set of actions performed before manufacturing, and quality control, a set of material controls performed during fabrication. The two successive phases of the quality management are presented. The difficulties and improvement possibilities are discussed. (FR)

23652 SODIUM VALVE OPERATING EXPERIENCE. Standardization. Elie, X.; Abramson, R.; Morier, F. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides); Vercasson, M. (Electricite de France, 77 - Ecuelles. Dept. Technologie Nucleaire). pp 201-203 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The existing valves are briefly described and the operating experience is presented. The requirements and qualification for sodium valves are given (general prescriptions and practice). (FR)

23653 TESTING PLUTONIUM FUEL ASSEMBLY PRODUCTION FOR FAST-NEUTRON REACTORS. Nougues, B.; Benhamou, A.; Bertothy, G.; Lepetit, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. de Developpement des Elements Combustibles). pp 205-208 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The main characteristics of plutonium fuel elements for fast breeder reactors justify specific test procedures and special techniques. The specific tests relating to the Pu content consist of Pu enrichment and distribution tests, determination of the O/M ratio and external contamination tests. The specific tests performed on fuel configuration are: testing of sintered pellet diameter, testing of pin welding and checking of internal assembly. (FR)

23654 INCIDENT DETECTION SYSTEM AND CORE SURVEILLANCE FOR FAST REACTORS. de Lapparent, D.; Gourdon, J.; Gouriou, A.; Jallade, M.; Le Guillou, G.; Pages, J. P.; Paziaud, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). pp 195-196 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The function of the system (permanent supervision, incident detection as quickly as possible, and automatic safety action) is discussed together with the possible incidents of the core (reactivity anomaly, fuel blockage, and pin failure). The Super Phenix system is described. (FR)

23655 CONTINUOUS LEVEL INDICATOR FOR CONDUCTIVE LIQUIDS. Lauhoff, T. (To Internationale Atomreaktorbau GmbH). German(FRG) Patent 2,345,932/A/. 20 Mar 1975. 11p. (In German).

A description is given of a continuous level indicator according to the induction principle for electrically conducting liquids, for example for the liquid sodium used in nuclear power plants, where a primary coil is energized by a constant alternating current and the induced voltage in a secondary coil is controlled and the coils are wound round the same rod-shaped core made of ferromagnetic material or of austenite steel. In order to protect the coils against the effect of corrosive liquids and against mechanical damage, they are mostly arranged in a closed cladding tube. (GE)

23656 IMPORTANCE OF FAST REACTORS FOR THE CONSTITUTION OF THE NUCLEAR POWER SUPPLY SYSTEM. Bobolovic, V. N.; Koryakin, Yu. I.; Levental, G. B. Arch. Energiewirtsch.; 29: No. 3, 275-286(Mar 1975). (In German).

The influence of various technological and economical parameters on the structure of an energy supply system with thermal and fast reactors is investigated. The time of the large-scale commercial use of fast breeders and their influence on the natural uranium demand as well as the plutonium supply all play an important part. (GE)

Research, Test, and Experimental Reactors

Refer also to abstracts 22412, 22995, 23614, 23926, and 24019.

23657 (BNWL-955) FFTF REFERENCE CONCEPT SUMMARY DESCRIPTION. Walker, R. C. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1969. Contract AT(45-1)-1830. 184p. Dep. NTIS $12.25.

The conceptual design of the FFTF reactor and experimental facilities is described. (JWR)

23658 (BNWL-1133) FAST FLUX TEST FACILITY. Monthly Informal Technical Progress Report, June 1969. Cabell, C. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 8 Jul 1969. Contract AT(45-1)-1830. 125p. Dep. NTIS $9.25.

Technical progress made in the Fast Flux Test Facility Program during June 1969 is summarized. (auth)

23659 (CONF-701074-P3, pp 1-29) OPERATION EXPERIENCE OF BUDAPEST REACTOR VVR-SM. Varkoni, L.; Sabo, F.; Frankl, L. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The improved reactor of the VVR-SM type has been operating since September of 1967. During this time the research work and the manufacture of isotopes has proven the technical decision for reconstruction. The reconstruction, the experience of operation of the fissile core, and the realization of the survey results are described. (auth)

23660 (CONF-701074-P3, pp 30-85) TRAINING-CUM-RESEARCH ATOMIC REACTOR OF THE BUDAPEST TECHNICAL UNIVERSITY. Diom; Chom, D.; Frankl, L. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet", Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

At Budapest Technical University the construction of a nuclear reactor with capacity of 10 KW(t) for training and research programs of the Budapest Higher Institute of Learning is in progress. The start of the reactor and its laboratory is planned at the end of the current year. (auth)

23661 (CONF-701074-P3, pp 96-130) REACTOR CONSTRUCTION IN THE POLISH PEOPLE'S REPUBLIC SURVEY REPORT. Bishevskii, V.; Niech, C. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

In the year 1958 in Poland, the start up of the research reactor of the VVR-S type, supplied by the Soviet Union, was accomplished. In the preceding years the capacity of this reactor was enhanced by two stages. In the first, in the 1964, the capacity of the reactor was raised from 2 to 4 MW(t) by changes of the heat-generating installation. The aim of this change was to increase the coefficient of heat transmission between the heat-generating installation and of cooling water and the decrease of temperature gradients along the length of the heat-generating installation. The construction decision for new cassettes for the heat-generating installations is discussed. In the second stage in the year 1966, the capacity of the reactor was increased to the level of 8-10 MW(t) by the use of heat-generating elements of the VVR-SM type and the use of a beryllium reflector. This increase of capacity of the reactor was connected with more complex re-building. The construction of the new fissile core of the reactor with a beryllium reflector and the components of the reactor which underwent re-building are discussed. The widened possibilities of the use of reactor are also described. (auth)

23662 (DP-MS-75-61) DECOMMISSIONING PLAN FOR THE HEAVY WATER COMPONENTS TEST REACTOR. Field, F. R. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 23p. (CONF-750822-3). Dep. NTIS $4.25.

From conference on decontamination and decommissioning of ERDA facilities; Idaho Falls, Idaho, USA (19 Aug 1975).

Three alternatives to decommission the Heavy Water Components Test Reactor (HWCTR) have been analyzed. No final choice has been made between alternatives, and all are feasible. Selection of a plan for decommissioning will depend on criteria that are presently being formulated within ERDA and other regulatory bodies. (auth)

23663 (EIR-278) ZPR-III-48 CENTRAL REACTIVITY COMPUTATIONS USING FGL-4 AND ENDF/B-GGC-3 CROSS SECTIONS. Hager, H.; Stepanek, J. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Mar 1975. 51p. Dep. NTIS (US Sales Only) $5.75.

A central reactivity study of the fast critical power reactor ZPR-III-48 was performed using FGL-4 and modified ENDF/B-GGC-3 cross sections in 37 groups. A comparison was made of experimental and calculated results. Both the first order perturbation theory and the eigenvalue difference method were used. It is shown that the most important limitation in the use of perturbation theory to determine the CRW for materials with predominant neutron scattering is their high sensitivity to the adjoint spectrum. Therefore the use of the classical flux weighting for computation of adjoint broad group cross sections is insufficient. The study shows that none of the libraries considered combined with current computation methods was able to give better performance in comparison to experiment than the recently studied ENDF/B libraries. (auth)

23664 (HEDL-SA-915) FFTF CONSTRUCTIBILITY. Weber, S. A.; Hulbert, D. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 25 Mar 1975. Contract AT(45-1)-2170. 22p. (CONF-750604-2). Dep. NTIS $4.25.

From US/USSR seminar on fast breeder reactor construction and experience; Obinsk, USSR (2 Jun 1975).

The influence of the design criteria on the constructibility of the Fast Flux Test Facility is described. Specifically, the effects of requirements due to maintenance accessibility, inerting of cells, seismicity, codes, and standards are addressed. The design and construction techniques developed to minimize the impact of the design criteria on cost and schedule are presented with particular emphasis on the cleanliness and humidity controls imposed during construction of the sodium systems. (auth)

23665 (HEDL-SA-916) TESTING EXPERIENCE WITH FAST FLUX TEST FACILITY. Noordhoff, B. H.; McGough, C. B.; Nolan, J. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 24 Mar 1975. Contract AT(45-1)-2171. 21p. (CONF-750604-3). Dep. NTIS $4.25.

From US/USSR seminar on fast breeder reactor construction and experience; Obinsk, USSR (2 Jun 1975).

Early FFTF project planning emphasized partial and full-scale testing of major reactor and plant prototype components under expected environmental conditions, excluding radiation fields. Confirmation of component performance during FFTF service was considered essential before actual FFTF startup, to provide increased assurance against FFTF startup delays or operational difficulties and downtime. Several new sodium facilities were constructed, and confirmation tests on the prototype components are now in progress. Test conditions and results to date are reported for the primary pump, intermediate heat exchanger, sodium-to-air dump heat exchanger, large and small sodium valves, purification cold trap, in-vessel handling machine, instrument tree, core restraint, control rod system, low-level flux monitor, closed loop ex-vessel machine, refueling equipment, and selected maintenance equipment. The significance and contribution of these tests to the FFTF and Liquid Metal Fast Breeder Reactor (LMFBR) program are summarized. (auth)

23666 (HEDL-TME-72-26) NUCLEAR ANALYSIS OF FTR CORE RESTRAINT REACTIVITY EFFECTS. Rothrock, R. B. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Mar 1972. Contract AT(45-1)-2170. 33p. AT.

Nuclear analysis work undertaken for the joint Westinghouse Advanced Reactors Division-HEDL Core Restraint Task Force in their task of selecting and developing a core restraint system for the FTR is described. Reactivity effects discussed include the effects of small radial deflections of core components and calculated reactivity effects of core geometry perturbations. Included are discussions of reactivity worth and worth gradient distribution; methods of calculation; the calculated effects at zero-power, full-power; the effects of core porosity; and irradiation effects during an operating cycle. (auth)

23667 (HEDL-TME-75-34) CALCULATIONS OF Eu_2O_3 AND B_4C WORTHS IN THE FAST TEST REACTOR ENGINEERING MOCKUP. Daughtry, J. W. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-2170. vp. AT.

The reactivity worths of B_4C and Eu_2O_3 were investigated and compared to provide input for the evaluation of europia as a possible control rod absorber material in fast reactors. The investigation was based primarily on a comparison of calculated worths and experimental worths obtained in the FTR engineering mockup. Reactivity worths were computed for safety rod, control rod and peripheral shim locations using two-dimensional diffusion theory. The analysis included an investigation of the effect of mesh size on computed rod worths. For Eu_2O_3 three cross section data sets were compared and resonance self-shielding effects were investigated. The comparison of calculated (C) and experimental (E) results provided C/E bias factors to be used for adjusting calculated FTR B_4C and Eu_2O_3 absorber rod worths. (auth)

23668 (KFK-2071) OPERATION OF THE FR2 RESEARCH REACTOR IN 1973. Moeller, I.; Steiger, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Reaktorbetrieb und Technik). Apr 1975. 147p. (In German). Dep. NTIS (US Sales Only) $10.50.

The heavy-water moderated research and testing reactor FR2 was operated to schedule at 44 MW nominal power in 1973. The availability of the plant was slightly improved. Experimental utilization through instrumented irradiation capsules strongly increased as compared to the previous year. Up to 16 capsule test rigs at a time were inserted in the reactor. As to the beam tube experiments, up to 13 experiments covering a total of 18 test rigs were conducted simultaneously at the 12 reasonably usable beam holes. At the beginning of the year all of the positions available were occupied by 5 loop experiments. On January 20, 1974, the experiment FR2/58 with a pressurized heavy water loop was terminated according to schedule. Isotope production reached its highest value with a total of 2,372 irradiated capsules (1.3% more than the year before). In addition to some minor interruptions in operation, the incident should be mentioned which took place on July 18, 1973 when the reactor was scrammed from 44 MW power operation as a result of partial failure of the 60 V dc power supply. Failure of a 50 A secondary fuse caused the excitation of all safety channels in the reactor containment. The voltage drop affected especially the program controls in the heavy water, helium, light water, and air circuits. However, at no time was reactor cooling endangered. The consequences to the environment remained clearly below the limits defined in the scheme on permissible gaseous effluents. (auth)

23669 (WARD-2171-49) FAST FLUX TEST FACILITY. Quarterly Progress Report, Period Ending 31 August 1974. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1974. E(11-1)-3045. 33p. AT.

Research and development activities for the FFTF reactor are reported under the following headings: reactor engineering; head compartment and shielding design; in-vessel handling machine and instrumentation and control system components, plant fluid systems and mechanical components; nuclear safety; and development testing. (JWR)

23670 (WARD-2171-50) FAST FLUX TEST FACILITY. Quarterly Progress Report for the Period Ending November 30, 1974. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1974. Contract E(45-1)-2171. 36p. AT.

Research and development activities for the FFTF reactor are reported under the following headings: reactor engineering; head compartment and shielding design; in-vessel handling machine, instrumentation, and control system components; plant fluid systems and mechanical components; nuclear safety; and FFTF material applications. (DCC)

Production and Materials Testing and Processing Reactors

23671 (CONF-701074-P3, pp 131-152) HIGH FLUX REACTOR SM-2. (Operation-cum-Technological Characteristics). Tsikanov, V. A.; Averyanov, P. G.; Koosovnikov, A. S.; Burukin, V. P. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The physical, technological, and operational characteristics of the SM-2 reactor, achieved following reconstruction and renovation of the fissile core, are depicted. Similarly, technological characteristics of the operation of circuits and systems of reactor are also depicted in brief form. (auth)

23672 (CONF-701074-P3, pp 153-173) SOME PHYSICAL PECULIARITIES OF THE REACTOR SM-2 AND ITS COMPARISON WITH OTHER HIGH-FLUX REACTORS. Tsikanov, V. A.; Kormushin, U. P.; Korotkov, P. I. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The basic physical peculiarities of the SM-2 research reactor, providing several technical advantages of the reactors of this type, are described. Comparison of trap type reactors (SM-2 and HFIR) with high-flux reactors without traps (Savannah River) shows that the trap-type reactors having substantial technical advantages may not be inferior to large Savannah River type reactors in output. (auth)

23673 (CONF-701074-P3, pp 174-249) METHODS OF TESTING MATERIALS IN A HIGH-FLUX REACTOR. Tsykanov, V. A.; Samsonov, B. V. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Methods of investigating materials in a high-flux reactor of the SM-2 type are described. Note is made of distinctive features of the reactor which influence the methods and the organization of investigations. Examples are cited of loop and ampoule irradiators and equipment for investigations of: (1) the mechanical properties of materials of construction, (2) the behavior of fuel-materials, (3) the electrical engineering parameters of insulating materials, and (4) the precision of thermocouple indications. (auth)

23674 (CONF-701074-P3, pp 250-289) METHODICAL QUESTIONS OF THE CONDUCT OF EXPERIMENTS OF NUCLEAR FUEL ELEMENT IN LOOPED CHANNELS OF THE REACTOR SM-2 AND MIR. Tsikanov, V. A.; Averyanov, P. G.; Sverov, A. A.; Zaletnikh, B. A.; Klochkov, E. P.; Kormushkin, U. P.; Kooprienko, V. A.; Matveev, N. P. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Information is provided about the basic characteristics and experimental stoppages for the low-temperature aqueous loop of SM-2, the sodium loop of the MIR, and aqueous high-temperature loops of MIR and SM-2. The sequence of operations is examined and several tasks regarding preparation and conduct of loop experiments are considered, as well as the corresponding requirements for the creation and maintenance of investigated ranges of operations of looped assemblies. The role of physical models of the reactors SM-2 and MIR in the study and creation of the required neutron-physical conditions of irradiation of nuclear fuel-elements in the looped channels is shown. (auth)

23675 (DP-MS-74-66) SPRAY COOLING OF HEATED CYLINDERS. Harris, S. D. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. 24p. (CONF-750804-2). Dep. NTIS $4.25.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

Heat transfer from heated horizontal cylinders cooled by a water spray was determined to aid evaluation of a spray cooling system for emergency cooling of irradiated nuclear fuel discharged in air from a reactor. In steady state tests, a test cylinder was cooled with a known steady spray as the heat generation rate was increased in steps; metal temperatures were recorded when steady state was reached. From these measurements, overall heat transfer coefficients were determined as functions of cylinder surface temperature, spray water temperature, spray density, and cylinder diameter. In transient tests, a test section was heated at constant power to various initial surface temperatures before cooling by the water spray. The results indicate the Leidenfrost point is a reliable guide to the ability of the spray system to arrest the temperature rise. 5 references. (auth)

23676 (LIB/Trans-571) PRINCIPAL CONSTRUCTION PROBLEMS OF SILOE. Chatoux, J. Translated by A. P. Marks from Bull. Inf. Sci. Tech. (Paris).; No. 78, 15-21(1963). 25p. Dep. NTIS (US Sales Only) $4.25.

A discussion is given of a number of problems that arose during the various stages of design and construction which could be divided into two main categories: (1) technical administrative and organizational problems which involved the personnel, (2) purely technical problems. (AT)

23677 (NP-20507, pp 1-5) NUCLEAR REACTOR TRIGA MAINZ. Menke, H.; Trautmann, N.; Weber, M.; Seyb, K. E. Jun 1975. (In German).

In annual report, 1974. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie).

23678 (ORNL-TM-5015) HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT. Progress Report, January–March 1975. McCord, R. V.; Corbett, B. L. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 22p. Dep. NTIS $4.25.

Reactor operation was routine this quarter with an on-stream time of 94.0%. The semiannual reactor component inspection was completed and the control plates were changed. A scheduled reexamination of the cracked permanent beryllium reflector was conducted. No changes were noted in the circumferential cracks on the inside surface of the beryllium, but two new hairline cracks were found on its outside surface. (auth)

23679 REFINING OF COAL. Schilling, H. D. (Steinkohlenbergbauverein, Essen (F. R. Germany)). Brennst.-Waerme-Kraft; 27: No. 4, 146-149(Apr 1975). (In German).

Gasification and liquefaction of coal as well as power generation from coal are main points of interest of the skeleton program "Energy Research" of the federal government and the technology program of the Federal Land Nordrhein-Westfalen. New techniques of coke production, power generation, gasification of anthracite, generation of new products by liquefaction of coal, production of active carbon from anthracite, and upgrading of anthracite are described. The special contribution of process heat from high-temperature nuclear reactors to these new techniques is mentioned. (GE)

23680 MAIN OUTLINE OF THE DEVELOPMENT OF HYDRO-NUCLEAR SYSTEMS FOR ENERGY DISTRIBUTION. Luxo, A. (Gaz de France, 75 - Paris); Vendryes, G. (CEA, 75 - Paris (France)). pp 262-266 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The hydronuclear systems and the state of development of the processes for hydrogen production, transport and utilization are reviewed. (FR)

23681 STUDY OF THE COUPLING OF AN ADVANCED HTGR WITH A WATER-SPLITTING PLANT. Esteve, B. (Gaz de France, 75 - Paris); Malherbe, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). pp 267-270 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Gaz de France is investigating the possibility of producing massive quantities of hydrogen by thermal decomposition of water using the heat provided by a HTGR type reactor. The problems induced by the coupling of a nuclear reactor with a water splitting plant are examined under the aspects of core performance and general design of the reactor. The thermochemical study of the three reactions of the adopted cycle (potassium cycle) is simultaneously carried out on the basis of available thermodynamic data. (FR)

23682 POTENTIAL MARKET AND CHARACTERISTICS OF LOW-TEMPERATURE REACTORS. Lerouge, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Reacteurs et de Mathematiques Appliquees); Aubert, R. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). pp 271-273 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The low-temperature (100 to 200°C) heat market for industrial applications and district heating is very important. Two main studies have been developed: a swimming pool reactor delivering water at 110°C and a prestressed concrete vessel reactor delivering water at 200°C. (FR)

23683 ECONOMIC OUTLOOK FOR NUCLEAR REACTORS IN THE PROCESS STEAM MARKET. Thiriet, L. (CEA, 75 -

Paris (France)); Daures, P. (Electricite de France, 75 - Paris). pp 275-277 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The economic aspects of nuclear reactors to supply industrial process steam are successively examined. (FR)

Propulsion and Package Reactors

Refer also to abstracts 22416, 22759, 23935, 23939, 23942–23953, 23956, and 24020–24025.

23684 (AGC-2279) PAYLOAD, COST AND RELIABILITY ANALYSIS OF SATURN C-5 AND NOVA WITH NERVA OR CHEMICAL THIRD STAGES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1962. 254p. Dep. NTIS $15.75.

Declassified 7 Sep 1973.

A preliminary study has been conducted to provide performance, operational cost and reliability data of the Saturn C-5 and NOVA launch vehicles for support of the design phase of the NERVA project. In addition to providing examples of NERVA engine performance and mission capabilities, it shows a direct competitive comparison with present and future typical chemical third stage systems. This visualization of the NERVA Rocket Engine in its correct operational environment is considered a necessary adjunct to the engine development program. Design compromises and product improvement on the engine itself, program scheduling toward the operational phases, and the operational life are to a great extent dependent upon this evaluation of the end use for the rocket and its vehicle system. The NASA Saturn and NOVA class systems were thus far compared for payload capability, performance, cost, stage and mission reliability, schedule and advanced mission potential, utilizing chemical or NERVA third stage propulsion. Conclusions from this study are: The burning time required in initial NERVA engines will be 1800 to 3500 seconds (later perhaps 1 to 6 hours); for all examined configurations the payload is greater using a NERVA third stage than with a chemical stage; rendezvous capability is required; and space operations break logically into two phases—boost to low orbit and space propulsion. The estimated economic advantage of a NERVA space stage over a chemically propelled stage exceeds a factor of two. (LTN)

23685 (AGC-2303-A) NERVA ENGINE WEIGHT AND BALANCE REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1962. Contract SNP-1. 14p. Dep. NTIS $4.00.

Declassified 7 Sep 1973.

A detailed weight breakdown for the heated-bleed NERVA Engine is provided which follows the format of the NERVA Engine Planning Parts List document. The weight breakdown for the hot-bleed engine is the same as for the heated-bleed system, except that the nozzle skirt inlet line assembly is omitted, and the cooled nozzle skirt is replaced with a 132 lb uncooled skirt. In addition, the turbine inlet line assembly is 6 lb lighter for the hot-bleed engine. The center-of-gravity and the moment-of-inertia of the gimbaled portion of the engine were not affected by the weight changes. The primary reactor shield was increased in weight from 2250 to 2330 lb as a result of a new weight analysis on the shield. The electrical power supply, which was included in the engine weight summary has now been omitted, resulting in a weight decrease of 88 lb. The other engine components have remained unchanged. (auth)

23686 (AGC-2319-A) RADIATION EFFECTS FACILITY (REF) CONCEPTUAL DESIGN: NERVA TPA/ASTR FACILITY. (Aerojet-General Corp., Sacramento, Calif. (USA)). 30 Sep 1962. 200p. Dep. NTIS $13.00.

Declassified 10 Sep 1973.

The need exists for development testing of certain components and subassemblies of nuclear rocket engines, under simulated engine operating conditions including nuclear radiation, prior to the testing of a complete engine. In particular turbopumps need to be operated at cryogenic temperatures in a high radiation field. The modification of the General Dynamics/Fort Worth ASTR facility for this specific purpose is investigated from the standpoints of feasibility, experimental operation, scheduling, and costs. (auth)

23687 (AGC-2323(Vol. 1)) NERVA ENGINE DEVELOPMENT PROGRAM AND ASSOCIATED TASKS, CONTRACT YEAR 1962. Summary Report. Volume I. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1962. Contract SNP-1. 284p. Dep. NTIS $17.25.

Declassified 11 Sep 1973.

Phase I of the SNP-1 Contract was principally a preliminary design and program planning phase and was completed on 10 January 1962. Contract Year 1962 has been devoted largely to an expansion of critical hardware research and development at the engine subassembly and component level. By direction of SNPO, no appreciable NERVA hardware procurement will occur until successful demonstration of the Kiwi reactor has occurred using liquid hydrogen. However, development of critical components and subassemblies must be initiated and continued if engine development testing is to start as scheduled. The critical components fall into two main categories —those longlead components which must be provided and/or those components whose behavior in the radiation-temperature environment is unknown. Also included in the Contract Year 1962 program is additional and more detailed and refined NERVA engine design effort; implementation of plans for the various engine-support systems and functions; extensions of the engine-development-program support activity; continued program planning; and certain expansions in the area of program controls. The Contract Year 1962 program as initially negotiated is defined in Aerojet Report 2199. During the course of the program, certain redirections and amended efforts were required. These redirections and amendments are included and discussed. (auth)

23688 (AGC-2719) EVALUATION OF KIWI-B2A MODULE FRACTURES DURING COLD FLOW. (Aerojet-General Corp., Azusa, Calif. (USA)). Oct 1963. 9p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Firm answers as to the cause of failure of the B-2A modules cannot be made, since the available data are somewhat ambiguous and inconclusive. However, the preponderant weight of evidence indicates the following. The core, cookie, rockers, and hoop can were severely stressed and shaken during the 20-35 sec time interval following initiation of liquid hydrogen flow. The most probable cause of failure is a rapid combustion of hydrogen and liquid air with an accompanying rapid pressure rise. This combustion could have occurred at the core inlet end with the air supplied by the non-purged plenum between the core and support plate, and by the non-purged annular plenum outside the inner core. These plenums contain approximately 2 ft^3 of air. The resulting pressure rise could have driven the sleeves into the modules. The rapid combustion of hydrogen and liquid air, accompanied by a rapid pressure rise, is not only possible but probable under the B-2A test conditions. This reaction is well known in the study of cryogenics. Mechanical overloading of the modules because of binding of the Invar sleeve in the seal plate is not considered very probable. There are no data from the B-2A test to indicate whether or not liquid hydrogen was trapped, and subsequently subjected to rapid heating causing module overpressurization. However, no module failure of the type under consideration occurred during the Kiwi B-1B cold flow test, in which the module design, purge procedures, and flow procedures (other than channel plugging) were similar to the B-2A. It is recommended that oxygen be excluded from the pressure vessel and nozzle immediately prior to and during the flow of hydrogen in all future cold flow reactor tests. In order to maintain low oxygen concentrations, a thorough nitrogen purge and other specified precautions are required. (auth)

23689 (AGC-6056-35) NERVA PROGRAM TECHNICAL REVIEW, FEBRUARY 26–28, 1962. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1962. 79p. Dep. NTIS $7.00.

Declassified 10 Sep 1973.

Material (mostly tables, diagrams and graphs) presented at the technical review is documented. (LTN)

23690 (AI-BD-AEC-70-28-1) S8DR REVIEW COMMITTEE BRIEFING AT ATOMICS INTERNATIONAL, DECEMBER 9–10, 1970. (Atomics International Div., Canoga Park, Calif. (USA)). 10 Dec 1970. 32p. Dep. NTIS $4.75.

Declassified 11 Jan 1973.

Data from a hot-laboratory examination of S8DR fuel are presented. (TWR)

23691 (LA-3642-MS) DESIGN STUDY OF LOW POWER, LIGHT WEIGHT ROVER REACTORS. Kirk, W. L.; Newman, H. J.; Anderson, R. C.; Hedstrom, J. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1966. Contract W-7405-eng-36. 38p. Dep. NTIS $5.00.

Declassified 29 Aug 1973.

Low power, light weight reactors for nuclear rocket propulsion were investigated in a study that was limited to the use of graphite-matrix fuel in geometries similar to the 19-hole hexagon currently in use in the Rover program. Both homogeneous and heterogeneous cores were studied, with major attention given to heterogeneous cores containing hydrogenous moderator. Various cell geometries and moderator materials are compared on the basis of reactor

weight per unit power. The characteristics of a reference reactor design based on the use of zirconium hydride are described. The properties of several hydrides are discussed in reference to their use in a nuclear rocket propulsion reactor. Thermal and neutronic analyses in support of the reactor design study are presented. (auth)

23692 (NJD-5) NRX/EST TEST PARAMETER LIMITS JUSTIFICATION. (Aerojet-General Corp., Sacramento, Calif. (USA); Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1965. 10p. Dep. NTIS $4.00.
Declassified 11 Sep 1973.

Test Parameter Limits are presented for the NRX/EST Test. The justifications for the selection of the limits are given and supporting references listed. The Flow Shutdown Chain Inputs, Scram Chain Inputs, and Cooldown Limits are similarly treated. The information will be useful to the engineering groups in the planning, testing, and conduction of NRX/EST tests. (auth)

23693 (RN-S-0014(Vol. 2)) PROGRAM ACCOMPLISHMENTS: CONTRACT YEAR 1963. Volume II. (Aerojet-General Corp., Azusa, Calif. (USA)). 30 Oct 1963. 311p. Dep. NTIS $18.75.
Declassified 7 Sep 1973.

Accomplishments in the Aerojet-General NERVA program for contract year 1963 are reviewed. Certain components have been redesigned: The turbopump was redesigned twice because the first restricted design led to a decreased efficiency; additional desirable features were added to the Mark IV design. Other design changes are specified. Fabrication difficulties with the pressure vessel to reactor interface gage and with the nozzle with a cast aluminum jacket represented serious problems and their solutions are described. Actuator problems, Dewar failures in the materials irradiation program, etc. are discussed. Organization and management problems involved in carrying out the complex task are mentioned. (LTN)

23694 (RN-S-0026(Vol.2)) NERVA PROGRAM DESIGN REVIEW PRESENTATION TO SNPO ON 13, 14, 15 NOVEMBER 1963. Volume 2. (Aerojet-General Corp., Azusa, Calif. (USA)). 30 Jan 1964. 348p. Dep. NTIS $20.50.
Declassified 7 Sep 1973.

Changes in program direction during the 1963 contract year required rapid readjustments and goal changes in the design and development effort. The change from the heated bleed engine cycle to the hot bleed cycle led to new requirements for the propellant feed system, mainly with respect to the turbine power control valve (TPCV) and the turbopump. With the turbopump, efforts were made to modify the MK III model to meet the increased requirements and the design of a new MK IV model was initiated. This new design was then modified in midyear to incorporate a thrust balance system, sealing provisions for wet pump operation, and other features providing for engine growth, higher pressures and other anticipated design changes. Testing of turbopumps and bearings in a radiation environment and under cryogenic conditions continued with satisfactory results. Other propellant feed system components are discussed more briefly. The Thrust Chamber Assembly (TCA) was also a major development item during the year. The design, development, fabrication and testing of components (such as pressure vessels, nozzles, support structures, etc.) are described. (LTN)

23695 (RN-S-0173(Vol.I)) NERVA TECHNICAL REVIEW MEETING AEROJET-GENERAL CORPORATION, SACRAMENTO, CALIFORNIA, NOVEMBER 17–19, 1964. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. Contract SNP-1. 243p. Dep. NTIS $15.25.
Declassified 10 Sep 1973.

Tables, graphs, and some text presented at the NERVA technical review meeting have been documented. The material covers information on most NRX reactors and initial XE design. (LTN)

23696 (RN-S-0173(Vol.2)) NERVA TECHNICAL REVIEW MEETING, 17–19 NOVEMBER 1964. Volume II. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec. 1964. 303p. Dep. NTIS $18.25.
Declassified 10 Sep 1973.

Reproductions of the revised material presented at the NERVA Technical Review Meeting held at Sacramento, California, November 17-19, 1964 have been documented. Immediately preceding the revised material for each speaker is a condensation of the speaker's discussion. (auth)

23697 (RN-S-0218) PRELIMINARY TEST REPORT FOR PHASE I-D (KIWI-TNT) OF THE COUNTERMEASURES RADIATION EFFECTS PROGRAM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. Contract SNP-1. 25p. Dep. NTIS $4.25.
Declassified 10 Sep 1973.

None of the nine materials tested appeared to have been significantly damaged by the transient pulse which resulted in exposures of 1.5×10^7R gamma, combined with 3.5×10^{14} n/cm^2 fast neutrons and 1.6×10^{15} n/cm^2 thermal neutrons. The final test specifications for the transient nuclear test (KIWI-TNT) of the Countermeasures Radiation Effects Program describes the details of capsule loading and testing. A total of nine pseudo-stable materials were tested at two integrated dosages. These included three main charge explosives (NASA-1, DATB, and TATB), HNS booster explosive, lead styphnate primary explosive, black powder, DATB/Viton, AK-14, and ammonium perchlorate/polystyrene propellants. A total of 18 capsules were loaded, with approximately 3.6 g of explosives or propellant in each. The capsules were painted with fluorescent paint and scribed on the side and bottom with the sample number. A typical loaded capsule is shown in Figure 1. Nine of these capsules were attached to the reactor pressure vessel approximately 2.3 ft from the center of the reactor. Nine additional capsules containing the same materials were attached to the reactor support structure approximately 5 ft from the center of the reactor. The irradiated samples were shipped to the General Electric Reactor Facility and the post-irradiation measurements performed. (auth)

23698 (RN-S-0280) FINAL TEST REPORT FOR PHASE I-C, COUNTERMEASURES RADIATION EFFECTS PROGRAM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1966. 107p. Dep. NTIS $8.50.
Declassified 10 Sep 1973.

This phase of the Countermeasures Radiation Effects Program was concerned with a thorough evaluation of high-temperature stable explosives and propellants, and determination of their radiation tolerance limits. The most promising explosives and propellant from Phase IB were tested, as were four new propellants and four new explosives. Four explosives were tested in mild detonating fuse (MDF) form, two of which had not previously been available. The basic capsule design was modified from that used in previous phases to permit continuous monitoring of temperature and pressure during irradiation to determine threshold exposure limits. Two new tests (thermal gravimetric analysis and strand burning rate) were used to evaluate irradiated samples. Data obtained resulted in the establishment of radiation exposure limits for the materials tested and will be used to select materials for the larger (80 gram sample) Phase II testing. (auth)

23699 (RN-S-0285) X-ENGINE COMMON ANALOG MODEL. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1966. Contract SNP-1. 26p. Dep. NTIS $4.50.
Declassified 10 Sep 1973.

The common analog model for the XE-1 engine is described. This represents the first grouping of equations describing the reactor subassembly, the non-nuclear components, and the engine feed system. The equations describing the ETS-1 facility are not included and will be supplied in Addendum I to this report in the near future. In accordance with the recent AGC-WANL agreement, the feed system equations were developed by AGC and the reactor equations by WANL. (auth)

23700 (RP-SR-0001(Vol. 2)) NUCLEAR ANALYSIS IN SUPPORT OF THE PHOEBUS-2 NOZZLE DEVELOPMENT PROGRAM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1965. Contract SNPC-35. 110p. Dep. NTIS $8.50.
Declassified 10 Sep 1973.

Nuclear analysis in support of the Preliminary Design Phase of the Phoebus-2 nozzle program has been completed. The objective was to provide radiation environment data early in the program to assure the development of a nozzle compatible with its service environment. Detailed analyses were performed using various point kernel and transport theory methods for definition of the nozzle radiation environment and corresponding nuclear heating. All significant sources of nuclear heating were considered with the results indicating a five-fold increase over corresponding values for the NERVA nozzle. (auth)

23701 (RP-TR-0007) PHOEBUS-2 NOZZLE DEVELOPMENT NUCLEAR ANALYSIS. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1966. 91p. Dep. NTIS $7.75.
Declassified 11 Sep 1973.

Nuclear heating data are provided for the Phoebus-2 reference nozzle as modified early in the Development Phase. The calculations were performed principally with the QAD-P5 point kernel code. However, secondary gamma sources were predicted with the TDC transport theory code. Heating rate data were generated for the entire nozzle assembly as well as for the interface region between nozzle and pressure vessel. These data were used in thermal and stress analyses of both the nozzle and pressure vessel. The uncertainty in these predictions is difficult to define. There appears to be a strong dependence on location with the

best accuracy for those regions with high heating rates. The QAD-P5 code, when used with water buildup factors, will generally tend to overestimate the gamma ray environment. This overestimate is believed to be small (≈ 2%) for the high heating rate regions and moderate (≈ 30%) for the low heating rate regions. The TDC code, with Mill's 18-group cross sections, appears to underestimate the fast neutron environment by between 12% and 60% in the nozzle region. This appears to be within the validity range of the measured data. The adequacy of the secondary gamma sources produced in the nozzle depends on the ability of TDC to define the thermal neutron environment. Thus, while the available data seem to show that the QAD-P5 code provides conservative results, appropriate data for a conclusive demonstration was not available. Hence a nominal uncertainty factor of +25% is recommended for use with the total heating rate data provided in Part I of this report. This means that design calculations performed with nominal heating rate values should be repeated with values increased by 25% to ensure that adverse conditions do not occur. (auth)

23702 (TID-24229) PROCEEDINGS OF THE THERMIONIC CONVERSION SPECIALIST CONFERENCE, MOUNTAIN VIEW, CALIFORNIA, NOVEMBER 1–2, 1967. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). Jul 1968. 322p. (CONF-671149-). Dep. NTIS $19.25.

Declassified 31 Aug 1973.

Separate abstracts were prepared for each of the 32 papers included. (JWR)

For abstracts of individual papers see: 22184, 22185, 22764–22770, and 23703–23725.

23703 (TID-24229, pp 9-18) THERMIONIC REACTOR DEVELOPMENT AT GENERAL ATOMIC. Pidd, R. W. (General Dynamics, San Diego, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Adminstration, Moffett, Field, Calif. (USA). Ames Research Center).

The General Atomic program in nuclear thermionics is directed towards the development of in-core thermionic reactors. Work on the development of a unit cell thermionic fuel element has progressed to the point where stable performance of 10 W/cm^2 has been achieved in both in-pile and ex-pile converters. Lifetimes for both tests are in a range consistent with anticipated space applications. As part of the fuel element development, technology programs are in progress on fuel fabrication development, tungsten cladding development, high temperature fuel-cladding interactions, high temperature insulator seals, sheath insulators and integral cesium reservoirs. The integration of fuel elements into a reactor concept began this year. The first test will involve a four-cell cluster and will attempt to determine the effects of liquid metal cooling and the interconnection of fuel elements. A series of critical experiments designed to validate nuclear calculations on thermionic reactor designs is underway. Technology programs involving subcritical experiments to measure neutron energy spectra, analysis of reactor stability, and development of more precise analytical methods have been in effect for the past two years. (auth)

23704 (TID-24229, pp 19-22) DEVELOPMENT STATUS OF REACTOR THERMIONICS FOR SPACE POWER APPLICATIONS. VanHoomissen, J. E.; Street, G. (General Electric Co., Pleasanton, CA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Progress in the development of a nuclear thermionic power system underway at General Electric's Nuclear Thermionic Power Operation (NTPO) is discussed. The discussion moves from the operation of single cells through the operation of Thermionic Fuel Elements (TFEs), the analytical characteristics of reactor and powerplant, to consideration of the powerplant system as a whole. Of particular note is the discussion of the results of recent in-pile tests. (auth)

23705 (TID-24229, pp 23-31) THERMIONIC REACTOR DESIGN UTILIZING IN-CORE EXTERNALLY FUELED DIODES. Flaherty, R. (Westinghouse Electric Corp., Pittsburgh, PA); Raab, B.; Ravets, J. M.; Schock, A. Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

An integral part of thermionic reactor development is the selection of a diode and reactor concept utilized in the power plant. Much work has already been expended using internally fueled diodes arranged in "flash-light" or "pancake" mechanical designs. An alternative design, based on externally-fueled converters, appears to have significant advantages over these previous designs. During the past year a joint Republic Aviation—Westinghouse Astronuclear Laboratory investigation was made of the externally-fueled design coupled with an advanced reactor mechanical design. This paper presents specific illustrative designs of such systems, for both the high (~10 megawatts) and intermediate (~300 kilowatt) power levels. It will be shown that this type of design is directly scalable. (auth)

23706 (TID-24229, pp 42-51) DESIGN FEATURES OF A NUCLEAR THERMIONIC POWER PLANT. Voorhees, B. G.; Hill, P. R.; Sawyer, C. D. (General Electric Co., Pleasanton, CA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Selected significant design features of the thermionic reactor and other major components which make up a nuclear thermionic power plant for supply of auxiliary electrical power in a space vehicle application are discussed. Considerations in the electrical design of the power plant are discussed particularly as they affect the design of the thermionic reactor. Considerations in selection of operating temperatures are discussed including trade-offs in weight and reliability which lead to the recommended selection of 1000°K (1340°F) as the reactor coolant outlet temperature and consequent use of stainless steel as the material of construction for the reactor and radiation liquid metal loops. (auth)

23707 (TID-24229, pp 52-61) PARAMETRIC DESIGN STUDIES OF A LOW-POWER THERMIONIC REACTOR. Sawyer, C. D.; Hill, P. R. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

An economic model of a low-power thermionic reactor was constructed and various alternative designs were compared. This led to the selection of a water-cooled concept using molybdenum emitters and bulk uranium dioxide fuel. In the final design studies, the thermionic fuel element and reactor physics/thermal hydraulics were optimized. Both boiling and nonboiling concepts were studied within the framework of natural convection cooling. Based on the parametric design, a low-pressure natural circulation non-boiling concept was selected fro a nominal 100 KW(e) reactor. (auth)

23708 (TID-24229, pp 62-71) LOW-POWER THERMIONIC REACTOR POWER PLANT FOR TERRESTRIAL APPLICATIONS. Hobson, R. R.; Gingrich, J. E. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The results of a preliminary design study of a transportable 100 kW(e) thermionic reactor power plant are discussed. The design emphasizing a minimum cost approach for a small terrestrial power plant by utilizing common construction materials and standard fabrication techniques wherever possible. The selected design is based on a natural-circulation, watercooled and moderated reactor with thermionic fuel elements. Shipping weight is minimized by using lightweight materials and available site water for cooling, moderating and shielding. The power plant consists of two compact modules to facilitate air shipment. Plant costs were estimated and the major cost elements are identified. The key development problems of the plant are discussed. (auth)

23709 (TID-24229, pp 72-81) HEAT PIPE RADIATOR SYSTEM ANALYSIS FOR THERMIONIC POWER PLANTS. DeMichele, D. W.; Gietzen, A. J. (General Dynamics, San Diego, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Heat rejection systems for thermionic power plants for manned space mission applications have been analyzed to determine their

specific mass, reliability and overall performance. Configurations studied utilized multiple independent pumped loops with an intermediate heat exchanger to carry the heat to radiator panels composed of many heat pipes. In addition to serving as radiating fins the heat pipes serve as meteoroid bumpers protecting the less multiple secondary liquid metal loops. Configurations of each portion of the system (heat pipes, liquid metal loops, pumps, and heat exchanger) have been optimized for minimum weight within specified constraints on radiator geometry and temperature dependent stress limits. The results presented include the influence of component multiplicity on system weight and reliability and the variation in system specific mass with reactor output power level. Comparisons are made between planar and cylindrical radiators and types of coolant fluids. (auth)

23710 (TID-24229, pp 82-88) OPTIMIZATION CALCULATIONS FOR THERMIONIC DIODES IN A SERIES STACK. Sutherland, C. D.; Frank, T. G. (Los Alamos Scientific Lab., NM). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The performance of a thermionic fuel rod consisting of fifteen thermionic diodes in series is calculated when the axial input power distribution is non-flat, but varies as a truncated cosine curve. The calculations are based on the numerical solution of a set of ordinary differential equations approximating electrical conduction and heat transport in a cylindrical thermionic diode. Experimentally determined current-voltage characteristics at constant cesium pressure are used to determine emission current density as a function of emitter temperature and voltage. Maximum power output and maximum efficiency are calculated for (a) a series of diodes with all emitter supports having the same resistance, and (b) a series of diodes in which the emitter support resistances are adjusted individually. This is done with the constraint that the maximum emitter temperature is 2100°K for values of minimum to peak (thermal) power ratio ranging from 1.0 to 0.6. The results show that considerable improvement in thermionic fuel rod output can be obtained by varying emitter support resistance versus choosing a constant support resistance for the series arrangement of the fifteen thermionic cells. (auth)

23711 (TID-24229, pp 89-95) EFFECT OF NONUNIFORM HEAT GENERATION ON TFE THERMIONIC PERFORMANCE. Sawyer, C. D.; Wilkins, D. R.; Hanvelt, R. A.; Hill, P. R. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The effect of a nonuniform emitter temperature, as a result of a nonuniform heat source, on the thermionic performance of individual converters and a series of physically identical converters has been studied. For individual converters, a nodal heat transfer model was constructed for a cylindrical emitter with a sinusoidally varying circumferential heat flux on the inner emitter surface. The thermionic performance was calculated from the emitter temperature distribution. For series of converters, an analytic model of a multicell device which took into account all important sources of heat and electrical power losses in each cell and for the device was constructed. Cell-to-cell variations in average emitter temperature were prescribed and both steady-state and 60-cycle sweeps were simulated. (auth)

23712 (TID-24229, pp 96-105) DYNAMIC CHARACTERISTICS OF A NUCLEAR THERMIONIC POWER PLANT. Wilkins, D. R.; McCandless, R. J. (General Electric Co., Pleasanton, CA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

An investigation of the dynamic characteristics of a nuclear thermionic power plant is performed. The power plant is composed of a thermionic reactor, intermediate heat exchanger, waste heat radiator, cesium supply system, power conditioning system, and power plant control system. It is coupled to an electrical load. A set of nonlinear differential equations which describe time-dependent phenomena in each of the power plant components is used to investigate the stability properties and transient characteristics of the open-loop power plant. A preliminary analysis of the power plant control system is presented. It is concluded that the power plant is stable, responds slowly to reasonable perturbations in the open-loop driving forces, and does not present any major control difficulties. (auth)

23713 (TID-24229, pp 106-115) STABILITY OF A FAST REACTOR WITH IN-CORE CESIATED THERMIONIC CONVERTERS. Hetrick, D. L.; Schmidt, T. R.; Davis, M. V. (Univ. of Arizona, Tucson). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Two spatially independent reactor models, the effective-lifetime model and the prompt-jump approximation, are used with a simple two-region lumped-parameter model for heat transfer to analyze reactor stability for conditions approximating those of an operating in-core thermionic reactor. An example is presented which shows that delayed neutrons can impair stability under certain conditions. With the effective-lifetime model (but not with the prompt-jump approximation) stable limit cycles are observed which increase the region of stability. For sufficiently large perturbations in power, finite escape times may exist with either model in linearly stable or unstable regions. Nonlinear heat transfer appears to improve stability. A wide range of system stability is demonstrated using various heat transfer coefficients for combinations of prompt-positive and delayed-negative reactivity feedbacks. (auth)

23714 (TID-24229, pp 116-125) REFRACTORY METAL FUEL ELEMENT STABILITY UNDER CONDITIONS OF HIGH BURNUP AND THERMAL CYCLING TO 1800°C. Newsom, D. L.; Collins, J. F. (General Electric Co., Cincinnati, OH). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Dispersion-type refractory-metal fuel elements, containing W and Mo matrices with UO_2 as the fuel, were developed for intermediate and long-time service in non-oxidizing gaseous coolants to 3000°C. These were evaluated by laboratory and in-pile testing. The various refractory metals and alloys evaluated as cladding have shown good thermal stability and compatibility with the fuel core in isothermal testing at 1600° to 2200°C. When thermal cycled rapidly between 200° and 1800°C with short dwell times at temperature, the W-UO_2 fuel elements showed low diametric growth after 100 thermal cycles. In irradiation experiments at temperatures ranging from 1400° to 2000°C, the W-Re-Mo-clad W-UO_2 and the Mo-clad Mo-UO_2 systems have shown capabilities of service in excess of 1600°C with complete containment of fission products under fission densities approaching 1×10^{20} fissions/cm^3. The Ta- and Ta-10W-clad W-UO_2 systems have been tested to burnups greater than 1×10^{20} fissions/cm^3 at 1650°C and 2×10^{20} fissions/cm^3 at 1435°C without distortion of the fuel element structure. (auth)

23715 (TID-24229, pp 168-177) EFFECT OF FUEL CONSTITUENT DIFFUSION ON EMITTER WORK FUNCTIONS. Holland, J. W.; Kay, J. (General Dynamics, San Diego, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Changes in the vacuum work function resulting from diffusion of fuel materials to the surface of cylindrical emitters were studied. The emitters were fabricated by means of hydrogen reduction of WF6 to yield a {100} preferred orientation. The emitters were operated in electrically heated thermionic converters in excess of 7000 h. Fuels investigated were 90UC-10ZrC and a W-60 Vol UO_2 cermet. At temperatures $\geq$1800°C the vacuum work function for both carbide and oxide emitters remained at 4.6 eV, the expected value for unfueled {100} emitters. At temperatures below 1800°C accumulation of fuel resulted in a work function decrease of the emitter containing the carbide fuel and an increase in work function for the emitter with the oxide fuel. The work function for the 90UC-10ZrC fueled emitter decreased from 4.6 eV at 1800°C to 3.55 eV at 1500°C following an S-shaped curve and remained at 3.55 eV for lower temperatures. The cause for the work function decrease was attributed to a substoichiometric carbon concentration and transport of excess uranium to the emitter surface. The work function of the oxide fueled emitter increased from 4.6 eV to 4.87 eV due to oxygen accumulation when the temperature was decreased to 1600°C. Correlation between emitter vacuum work function and cell performance in the presence of fuel is discussed. (auth)

23716 (TID-24229, pp 229-236) DESIGN OF A FOUR-CELL CLUSTER TEST. Fisher, C. R. (General Dynamics, San Diego, CA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

A segment of a thermionic reactor containing a cluster of four thermionic fuel elements was designed and is currently under construction. The cluster of elements is electrically heated and operates in a helium environment. The helium gas provides a thermal bond between the heaters and converters and also between the converters and heat sink. The heat sink is made of a niobium alloy and cooled by circulating eutectic NaK. The heat sink design employs "ribbon duct" coolant channels and copper inserts between diodes to smooth temperature distributions. The thermionic fuel elements are located in the heat sink on a close spacing and use flexible, interconnecting leads to provide two parallel, series strings of two fuel elements each. Data expected from this test include effects of mechanical interactions between fuel elements through the series connectors and the effects of ribbon duct coolant passages coupled to thermionic cells. (auth)

23717 (TID-24229, pp 237-243) FABRICATION AND BACK EMISSION TESTING OF AN UNFUELED THREE-CELL THERMIONIC FUEL ELEMENT. Dunlay, J. B. (Thermo Electron Corp., Waltham, MA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Test results are presented for the back emission testing of an unfueled three cell TFE. Back emission testing utilizes electron emission from externally heated collectors to heat the emitters. By raising the collector temperatures and applying a voltage across the TFE, a back emission current flow can be achieved which can raise the emitter temperatures to normal operating levels. The design of the test unit is discussed. (auth)

23718 (TID-24229, pp 244-253) LONG TERM IN-PILE OPERATIONS OF A FUELED THERMIONIC CONVERTER AND A UNIT CELL FUEL ELEMENT. Holland, J. W.; Yates, M. K.; Schwarzer, D. E. (General Dynamics, San Diego, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Uranium oxide fueled thermionic converters and fuel elements were fission heated for extended durations to determine performance levels and stabilities. One oxide fueled converter has operated for over 4000 hours and is still in operation at an average power density of 10 W/cm^2 with negligible changes in relative power or efficiency. Operation of a unit cell fuel element fueled with UO_2 has exceeded 1000 hours at an average power density of 7 W/cm^2 with no change in relative power or efficiency. (auth)

23719 (TID-24229, pp 254-263) FISSION GASES IN THERMIONIC CONVERTERS. Holtslag, D. J. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

A program is being conducted to evaluate the effects of fission product gases on diode operation. Results from an instrumented converter having fission gases vented into the diode space are presented. An in-pile converter having a complete fission gas handling system is described. (auth)

23720 (TID-24229, pp 264-271) DESIGN, FABRICATION, AND IN-PILE OPERATION OF THERMIONIC FUEL ELEMENTS. Samstad, G. I.; Gilliland, D. L. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The thermionic Fuel Element consists of a number of nuclear fueled cylindrical thermionic converter cells connected in series electrically to form a reactor fuel rod. In a continuing development program, several prototypical TFEs have been fabricated and successfully tested. These TFEs consist of several closely spaced series connected cells with each cell composed of a UO_2 fueled tungsten emitter, niobium collector, insulator and outer sheath. This paper describes the evolution of the design and fabrication of these TFEs as well as a detailed discussion of the recent operating characteristics and life test operation. (auth)

23721 (TID-24229, pp 271-279) ADDITIONAL TEST RESULTS ON IN-PILE CONVERTER SD-4. Howard, R. C. (Thermo Electron Corp., Waltham, MA). Jul 1968.

From national symposium of the ISA analytical instrumentation division; Austin, Texas, USA (19 Apr 1971).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

At the last Thermionic Conversion Specialist Conference, a paper was presented on the in-pile and out-of-pile testing of Converter SD-4. During the past year the in-pile testing has continued, although some difficulty has been encountered in controlling the cesium reservoir temperature. This paper describes the additional test period and summarizes the performance results obtained. (auth)

23722 (TID-24229, pp 280-292) POST-IRRADIATION EXAMINATION OF THERMIONIC CONVERTERS. Danko, J. C.; Gregory, T. L.; Boyle, R. F. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Post-irradiation results are reported on a number of single-cell in-pile converters (SCIP) and several three-cell thermionic fuel elements (TFE). All the SCIPs and TFEs had chemical vapor-deposited (CVD) tungsten emitters and bulk UO_2 fuel. Two of the SCIP emitters were vented and one was instrumented with thermocouples; all had nickel collectors. All of the TFEs had unvented emitters; two were a nominal one-inch diameter with niobium collectors, while a third TFE was 0.6 inch size with a composite nickel-niobium collector body. All of the TFEs had an outer Kovar sheath bonded in an inner sheath of alumina. (auth)

23723 (TID-24229, pp 293-303) POST-OPERATIONAL EXAMINATIONS OF THERMIONIC CONVERTERS. Horner, M. H. (General Dynamics, San Diego, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

Post operational examinations were conducted on in-pile and ex-pile fueled converters. The tests had been run up to 3,300 hours in-pile, and up to 10,406 hours ex-pile. Post operational evaluations were performed by visual examination, metallographic analyses, X-ray diffraction, electron beam microanalyses, leak-tests, dimensional measurements, gamma counting and alpha counting. A fuel-cladding interaction was observed which resulted in one shorting failure. Evidence of cesium corrosion of insulator-seal metallized joints was found. Converter envelope cesium leaks through copper-titanium braze joints were found. Correlations among fuel preparation, diode envelope construction and the examination results led to an upgrading of the fuel fabrication techniques and the converter components. These examinations have proven to be a valuable part of the converter development cycle. (auth)

23724 (TID-24229, pp 304-309) IN-PILE EMITTER TEMPERATURE AND INPUT POWER DETERMINATIONS. Clark, A. F.; Holtslag, D. J. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

The methods of establishing values of the critical parameters of emitter temperature and input power utilized to measure performance and control the operation of the SCIP series of in-pile thermionic converters are described. The methods utilized to determine emitter temperatures are: direct thermocouple readings, ignition current diagnostic technique, and heat transfer calculations after first determining input power. The methods utilized for determination of power input are: calorimetric balance and heat transfer calculations made after first determining emitter temperature. The paper describes the physical arrangements, design features and calculational method and compares the results of recent tests where these techniques have been used. (auth)

23725 (TID-24229, pp 310-318) DIAGNOSTIC TECHNIQUE FOR THE INDIRECT DETERMINATION OF THERMIONIC CONVERTER EMITTER TEMPERATURES. Wilkins, D. R. (General Electric Co., Pleasanton, CA). Jul 1968.

From thermionic conversion specialist conference; Mountain View, California, USA (1 Nov 1967).

In proceedings of the thermionic conversion specialist conference. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center).

A diagnostic method for determining thermionic converter emitter temperatures from experimentally measured output current characteristics is described and applied to the analysis of experimental data from both out-of-pile and in-pile converters. The diagnostic technique is based, in part, on previous analyses of the extinguished mode of converter operation, and in part on semi-empirical arguments. Attractive features of the techniques are that it has a potentially high degree of accuracy, does not require special design features or instrumentation on experimental converters, and can be rapidly implemented in practice. (auth)

23726 (TID/SNA-1410) TEMPERATURE MEASUREMENT SYSTEMS. Chandon, H. C. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 1 Feb 1964. 75p. Dep. NTIS $6.75.

There are four operational temperature measurement systems in the Liquid Rocket Plant Test Area. They are: the Thermocouple System, the Bridge-in-head Ambient Resistance Temperature Transmitter (RTT) System, the Cryogenic Constant Current RTT System, and the Bridge Completion RTT System. The thermocouple system, as the name implies, measures temperature with thermocouples. Signal conditioning for thermocouples is achieved by voltage substitution. Temperature measurements presently cover the range of −425°F to +2500°F. This system will be expanded to measure to 4200°F when the development of Tungsten-Rhenium thermocouples is completed. The bridge-in-head ambient RTT system measures temperature with an RTT that contains all resistors in a housing such that the electrical circuit is a Wheatstone bridge. Signal conditioning for this system is also achieved by voltage substitution. This system is designed to make measurements in the 0°F to 500°F region. The most recently developed temperature measuring system, the cryogenic constant current RTT system, was developed for the NERVA Component Test Program at Sacramento. This system measures temperature with a platinum resistance element. A four-wire system measures the platinum element resistance by measuring the voltage drop across the element caused by a constant current flowing in the circuit. The system is calibrated by resistance substitution and covers the range of 0 to 5000 ohms. RTT's have been developed to cover the region of −425°F to +75°F. A bridge completion system is also available for measuring cryogenic temperatures. In this system a platinum element RTT forms the fourth leg of a Wheatstone bridge to measure resistance. The resistance of the RTT is measured and converted to temperature by recording the output voltage from the Wheatstone bridge circuit. The bridge completion system is also calibrated by resistance substitution. The system is presently undergoing modification to meet the requirements of the NERVA and M-1 programs. Three systems are discussed in detail. The bridge completion system is being modified, so details are not being incorporated. (auth)

23727 (TID/SNA-3009) TEST REPORT FOR NRX-A S/N 0000004, 3.4-03-NNN-001 THROUGH 3.4-03-NNN-009. Rice, R. E. (Aerojet-General Corp., Sacramento, Calif. (USA)). 21 Jul 1964. 53p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

The LO_2/LH_2 test series 3.4-03-NNN-001 through 009 is described. The nozzle utilized, S/N 0000004, was the first completed NRX-A cast aluminum nozzle, part number 284800. The LO_2/LH_2 test series was conducted on Test Stand C-6 in the Liquid Rocket Plant Test Area. The test series ran from 17 August to 10 September 1963. The primary purpose of the test series was to evaluate the operational characteristics of the cast aluminum nozzle. Principal use of data was for evaluation of coolant tube heat transfer conditions. Since the test series 3.4-03-NNN was completed, S/N 0000004 nozzle has been utilized for cold flow tests with liquid hydrogen while mated with the pressure vessel and other engine components. The nozzle was also utilized for liquid nitrogen cold flow tests for the purpose of evaluating contact conductance. The evaluation of thermal conductance is treated in a separate report. The nozzle jacket was cooled gradually with LN_2 prior to firing to reduce the thermal gradients when liquid hydrogen rushed through the chamber. By this means jacket failure was avoided. (Such failures had occurred in previous tests with KIWI nozzle S/N 001K and Reactor Backup nozzle S/N 002L. Neither of these nozzles were prechilled.) (auth)

23728 (TID/SNA-3024) ABSTRACTS OF SYMPOSIUM PAPERS. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). Mar 1971. 82p. Dep. NTIS $7.25.

Abstracts of symposium papers are presented on the following topics: space nuclear systems and applications; radiation aspects of vehicle definition studies for nuclear propulsion systems; SNAP reactor shielding; natural space radiation shielding; space radiation dosimetry; natural space radiation; human responses to radiation exposures; space operations in the presence of manmade radiation; thermionic nuclear electric systems; solar cosmic rays and mission effects; radiation transport and shielding methods; radiobiological implications; nuclear propulsion systems shielding and radiation effects; physics data on radiation transport; geomagnetic trapped radiation belts; radiation effects and dosimetry; clinical data from radiobiological experiments; Monte Carlo techniques for radiation transport and shielding; natural space radiation effects on instrumentation; space operations in the presence of natural space radiation; electron transport; radioisotope thermoelectric generator radiation environments; atmospheric and supersonic transport radiation environment; and space radiation dosimetry. (DCC)

23729 (TID/SNW-77) OPERATING LIMITS NRX-A2 REACTOR. Revision 1. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 17 Jul 1964. 34p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

The constraints within which NRX-A2 reactor operations will be accomplished at the Nuclear Rocket Development Station, NRDS, are defined. These limits include both Management Controls and Operational Controls. Management Controls define the administrative limits associated with the NRX-A2 Operations Program. These limits include the definition of the test organization, the required documentation and the documentation approval mechanism. Operational Controls define the boundaries, procedural safeguards and operating safety limits, within which NRX-A2 operations will be completed. The scope of operations covered by this document includes those operations from receiving and inspection through post-test disassembly. (auth)

23730 (TID/SNW-3008) COMPARISON OF THE FULL FLOW AND HOT BLEED ENGINES FOR NERVA APPLICATION. Book 2. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1969. 54p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

In May, 1968 it was proposed that WANL perform a feasibility study of the Nuclear Subsystem (NSS) in the Full Flow Engine (FFE) and determine the effect of the FFE concept on the NSS design. The results of the basic WANL study were documented in detail. The effect of further changes made to the NSS Reference Design is documented and a summary of the WANL FFE studies is included. In changing from the Hot-Bleed Engine (HBE) to the FFE, the NSS is affected in two general ways. Pressure levels and component ΔP's are altered in various areas of the NSS, and provisions must be incorporated for discharge of the flow from the reflector outlet plenum to the turbine and for accepting the returned turbine discharge flow. From these evaluations it has been determined that the Nuclear Subsystem of the Full Flow Engine is technically feasible. (auth)

23731 (UCRL-6238(Del.)) APPLICATION AND EVALUATION OF CERAMIC MATERIALS IN TORY REACTOR SYSTEMS. Moyer, J. H.; Myers, W. B.; Walter, C. E.; Wells, W. M. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Nov 1960. Contract W-7405-eng-48. 34p. Dep. NTIS $4.75.

Declassified 26 Nov 1973.

The Tory series of test reactors is intended to lead to a reactor capable of use as a ramjet power plant. Current designs are presented. Beryllium oxide is presently the only serious contender as the moderator. Analytical and experimental treatment of the thermal stress problem in BeO is discussed. There is a requirement that a ramjet reactor sustain very large forces caused by flow-induced pressure drop. Development of ceramic structural elements to sustain these forces is discussed. (auth)

23732 (WANL-PR(J)-022) NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 April 1963–30 April 1963. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 May 1963. 72p. Dep. NTIS $6.75.

Declassified 10 Sep 1973.

Progress in the design and testing of NRX-A1 and NRX-A2 reactors and their components is reported. Fatigue test results on fuel elements and titanium specimens are described. Several tests involved various supports used in the reactor. Developments, tests and analyses of components of reactor control systems continued. Fuel element process development, control and testing (including corrosion testing) required considerable effort. (LTN)

23733 (WANL-PR(J)-026) NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 August 1963–31 August 1963. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Sep 1963. 84p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

The banded core concept was approved by SNPO and AGC and adopted by WANL. Regardless of the abnormality, no vibrations have been found with the inlet end clamped. In unbanded cores vibrations could arise from such abnormal conditions as excessive leakage through the seals or loss of lateral support spring forces. Fuel element development and quality control, flow and corrosion testing results are reported. Neutron absorbing stainless steels (containing 1% gadolinium or boron) were fabricated and tested. Many other details are reported. (LTN)

23734 (WANL-PR(J)-051) NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, 1 October 1967–30 September 1968. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Oct 1968. 194p. Dep. NTIS $12.75.

Declassified 11 Sep 1973.

The successful test of the NRX-A6 reactor was the highlight of the past year's activities. This reactor ran for slightly over an hour at slightly above design temperature and power as measured from exit gas and in-core thermocouples and from the nozzle flow relationship. The reactivity loss was significantly less than expected. The post test condition of the reactor was good and additional operating time could have been accomplished. The foundation for the test success was the superior performance of the improved NRX-A6 fuel elements. The slight amount of corrosion after more than twice the full power operation of previous reactors is indicative of the aggressive fuel improvement program which has been pursued. The XE-1 reactor shipped to NRDS during the previous contract year continued to be available for test in the down-firing configuration. It is now in storage at the E-MAD building. The XE-2 reactor was shipped to NRDS on 10 June 1968. The reactor will be assembled into the XE prime engine for tests throughout the next contract year. Fuel and cluster hardware for experimental WANL units in PEWEE-1 were shipped and assembled at LASL into their reactor which was shipped to NRDS on 12 September 1968. The PEWEE-1 reactor is presently being assembled onto the test car at the R-MAD building preparatory to a mid-December 1968 test. Support and participation with the SNPO Shielding Committee, provided in an effort to define the mission shielding requirements, culminated in an extended and detailed radiation and shielding analysis program with AGC to optimize the system shielding for minimum weight and mission flexibility. The application of the AF 375 system approach to the NERVA development was instituted. It required a period of study to understand the system, to define its application to NERVA, and to initiate implementation. In parallel with development of the 375 system and of the SNPO program requirements, WANL expended considerable effort on a NERVA-1 reactor design including a complete set of specifications, definitions, and initiation of component testing and critical test hardware. During the year WANL experienced two major reductions in force due to funding limitations. This resulted in a 40 percent manpower reduction. (auth)

23735 (WANL-PR(J)-059) NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, 1 October 1969–30 September 1970. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Oct 1970. 109p. Dep. NTIS $8.50.

Declassified 11 Sep 1973.

At the beginning of the contract year, the decision had been made to convert from the hot bleed cycle to the full flow cycle and to increase the endurance requirements from 1-hour to 10-hours. Trade studies were undertaken on all nuclear subsystem (NSS) components and systems design areas. Interactions between WANL, ANSC and SNPO on these trade studies and on companion engine trade studies resulted in the final definition of the reactor and its system for detailed PDR analysis. The program has been successful in limiting the areas in which alternate designs need further investigation to the core area. In the area of systems analysis, effort has been initiated to develop a common digital model with ANSC as a means for more consistent analytical evaluation. All of the required analyses and evaluations in support of the XE program were completed. The primary objectives of fuel fabrication were completed. The brazing of PW-II orifices was accomplished; BATH fabrication parameters were refined; Ti hydriding studies were completed; hydrogen environment testing was initiated; the GTR 20 irradiation was completed; the PBRF irradiations were instituted; the planning for fracture mechanics tests was completed; beryllium fracture mechanics data were successfully accumulated; and the R-1 spring materials were defined. Vacuum friction studies and the development of a non-corrodible periphery material were initiated. Major WANL efforts were applied to studies and plans for the NSS tests and the facilities required at NRDS for the NERVA Reactor Tests. In conjunction with the NRTO assumption of responsibility for the Pewee test, WANL initiated efforts in support of the NRTO Pewee test responsibilities. (auth)

23736 (WANL-PR(J)-061) NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, 1 October 1970–30 September 1971. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 Nov 1971. 116p. Dep. NTIS $9.00.

Declassified 11 Sep 1973.

Major efforts were involved in systems and design engineering in support of the NERVA program, especially with respect to bearings, scrubbers, thermocouples for very high temperature measurement, etc. Mathematical models of reactor behavior were improved. Fuel element fabrication, coatings deposition and testing required a major effort. The accumulation of materials properties for design purposes continued, as did the development of advanced materials to meet the severe environment encountered in some NERVA applications. Fracture toughness measurements of various materials were made over a range of temperatures, and included a study of the effects of hydrogen embrittlement on the fracture properties of NERVA materials. The development of noncorrodible, insulating, creep resistant materials and of composite materials for special purposes is reported. Brazing of carbide-coated graphitic materials required the solution of several difficult problems, which are discussed. To aid in solving many of these materials problems, contracts have been established with skilled outside organizations. (LTN)

23737 (WANL-TME-003) HEATING RATE CALCULATIONS. Capo, M. A.; Call, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 12p. Dep. NTIS $4.00.

Declassified 14 Jul 1975.

Heating rate calculations are presented for several traverses in the KIWI B-1 reactor core, pressure vessel, support plate, and reflector. Calculations were also made along the centerline of a typical lithium hydride-stainless steel shield. The configuration used in these calculations consisted of the reactor core, the graphite and beryllium reflector, the aluminum top support plate, a cylindrical aluminum pressure vessel, and a typical lithium hydride – stainless steel shield. (auth)

23738 (WANL-TME-005) PAYLOAD DOSE RATE FROM DIRECT BEAM RADIATION AND EXHAUST GAS FISSION PRODUCTS. Capo, M. A.; Mickle, R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 8p. Dep. NTIS $4.00.

Declassified 14 Jul 1975.

A study was made to determine the dose rate at the payload position in the NERVA System (1) due to direct beam radiation and (2) due to the possible effect of fission products contained in the exhaust gases for various amounts of hydrogen propellant in the tank. The gamma radiation was more significant than the neutron flux. Under different assumptions the gamma contribution from the exhaust gases was 10 to 25 percent of total gamma flux. (LTN)

23739 (WANL-TME-063) B-1 AND B-2 REACTOR DESIGN SUMMARY. Pierce, B. L.; Woods, M. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1962. 57p. Dep NTIS $6.00.

Declassified 10 Sep 1973.

To complete the preliminary B-1 and B-2 reactor designs, steady-state analysis of the heated bleed reactor was continued. The additional thermal design effort was directed toward the adjustment of flow distribution in the reflector flow system and the cores to provide more desirable NERVA reactor designs than developed during Phase 1. The design data summarized should not be interpreted as final NERVA flight engine thermal design information. Many significant parts have not been investigated. Further detailed thermal design is required if the B-1 or B-2 type core is chosen for the final NERVA engine design. (auth)

23740 (WANL-TME-100) COOLDOWN HISTORY OF KIWI B-1B REACTOR. Howarth, W. L.; Knecht, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Aug 1962. 30p. Dep. NTIS $4.50.

Declassified 21 Jul 1975.

The cooldown schedule proposed for the KIWI B1B reactor was reexamined. The basic criteria for the proposed cooldown schedule were as follows: For the first second after shutdown, liquid hydrogen is used. At the end of this time interval gaseous helium is introduced into the reactor and remains on until the core temperature is below 1400°R (temperature at which the N_2-UC_2 reaction is considered negligible). Below 1400°R gaseous nitrogen is used to cool the reactor. It was found necessary to

revise the proposed cooldown schedule to prevent the core temperature from exceeding the N_2–UC_2 temperature limit. The two schedules (proposed and revised) are shown. The decay heat computer code was used to calculate the cooldown temperatures of the reactor components for the revised cooldown schedule and are presented in curve form for 0 to 450 seconds after shutdown. Curves are also presented to estimate the time for the reactor to heat up from 700°R to 1400°R as a function of time after shutdown with no cooling flow and to indicate the amount of nitrogen coolant used during cooldown as a function of time after shutdown. (auth)

23741 (WANL-TME-102) FUEL ELEMENT TEMPERATURE LIMITATIONS. Thomas, G. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Aug 1962. 5p. Dep. NTIS $4.00.

Declassified 21 Jul 1975.

A tentative estimate of the recommended maximum temperature of NERVA fuel elements is 2900°C or approximately 5700°R. However, for a number of reasons, a few channels will be hotter than the average due to manufacturing deviations; also, some error must be allowed for in the chamber temperature measurement and control processes. The allowance for these factors is not well known at present, but it appears that operation at 150–350°R less than the maximum recommended temperature is required until those factors can be determined more precisely. The possibility of a self-aggravating condition in the hottest channels should also be considered. (LTN)

23742 (WANL-TME-150) NERVA SHIELD CAPSULE IRRADIATION PROGRAM: ENGINEERING DESIGN, SAFEGUARDS ANALYSIS, AND OPERATING MANUAL. Vogel, M. A.; Jacobs, D. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Oct 1962. 32p. Dep. NTIS $4.75.

Declassified 21 Jul 1975.

A program for irradiating in the GETR reactor lithium hydride pellets in a stainless steel capsule is developed. (LTN)

23743 (WANL-TME-184) PRE-OPERATIONAL REPORT OF A BEARING COMPONENT MATERIAL IRRADIATION TEST. Coombe, J.; Kubancsek, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Nov 1962. 37p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

A series of solid lubricants of WSe_2, Cu and Teflon; WSe_2, Ag and Teflon; $MoSe_2$, Ag and Teflon; WSe_2, Bronze and Poly-imide; $MoSe_2$, Bronze and Poly-imide; WSe_2, Bronze and Poly-imide; 404C Stainless Steel and $MoSe_2$ have been developed. These dry solid lubricants have an application in the control drum bearing of the NERVA reactor control system. In order to determine the behavior of these lubricants in a radiation field, and therefore select the best material for this application, a screening test has been designed using the shuttle tube irradiation facility in the GETR reactor. The fabrication of capsules that provide a hydrogen atmosphere and an evacuated atmosphere for these types of solid lubricants were designed and fabricated. The design of these capsules and a description of the fabrication along with the parameters of the irradiation tests are discussed. (auth)

23744 (WANL-TME-212(Rev.1)) PROPOSED AMENDMENT TO PROJECT 1980: RADIATION EFFECTS PROGRAM. Appendix I. 400 Hour Irradiation Test at GTR. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Jan 1963. 11p. Dep. NTIS $4.75.

Declassified 16 Jul 1975.

One 400-hour test at the GTR is considered necessary for the purpose of irradiating, under cryogenic conditions, a number of large core mechanical components and assemblies which cannot readily be accommodated by other reactor facilities at the present time. Since the components intended for testing will encounter high flux levels during NERVA operation, it is imperative that these GTR tests be extended for 400 hours to obtain integrated fluxes of sufficient magnitude to provide meaningful results. Generally, each component or assembly will be comprised of a number of smaller parts and components and will be irradiated under conditions of stress, dynamic loading or cycling, etc., which stimulate those conditions expected in service. Such testing of composite specimens will enable an evaluation of overall performance characteristics in addition to providing information on the influences exerted between inter-related parts. Further, these tests should pinpoint any gross problem areas and subsequently aid in design modifications before NRX testing is commenced. (auth)

23745 (WANL-TME-224) STATUS REPORT OF TANK HEATING CALCULATIONS FOR NERVA. Woodsum, H. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1963. 39p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

Preliminary calculations of the heating distribution and integrated heating in liquid hydrogen due to radiation incident on the NERVA hydrogen propellant tank, and the temperature rise of hydrogen leaving the tank assuming either of two fluid flow models are reported. The calculations were done using Monte Carlo heating rate functions calculated at the Marshall Space Flight Center. These functions have been incorporated into two codes designated TIC-TOC and TOE and these codes have been used along with sources derived from data given in earlier Westinghouse documents to obtain the heating results. A comparison of calculations using TIC-TOC with similar calculations using a Monte Carlo code developed by the United Nuclear Co. shows good agreement of integrated results. (auth)

23746 (WANL-TME-226) RADIATION ENVIRONMENT INSIDE AND OUTSIDE OF THE NRX-A-1. Sephenson, L. D.; Nassano, R. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Dec 1962. 34p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

Calculations of the gamma dose rate and the fast neutron flux (E > 1 MeV) have been completed for regions inside and outside of the NRX-A-1 reactor vessel. Neutron and gamma ray spectra have been computed at important locations within the NRX-A-1 reactor vessel. A comparison of various calculational methods was made at several of these positions. The effect of temperature and coolant on the fast neutron flux was demonstrated on a radial traverse on the core midplane and on an axial traverse through the core and support plate. The results are based on the NRX-A-1 design and calculations made in the period August–October, 1962. They will be superseded by analysis of the final design which should be available in the spring of 1963. The flux, dose rate, and spectra data apply to the NRX-A-1 which has been operated at a constant power level for twenty consecutive minutes. (auth)

23747 (WANL-TME-239) HEATING RATE DISTRIBUTION IN NRX-A-1 DURING OPERATION AND AFTER SHUTDOWN. Nassano, R. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Jan 1963. 33p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

Nuclear heating rate distributions are calculated for the NRX-A-1 reactor-shield assembly for various times during start-up, during full power operation, and after shutdown. (auth)

23748 (WANL-TME-253) DECAY HEAT COOLING ANALYSIS OF A NUCLEAR ROCKET ENGINE. Paper Presented at ARS/ANS/IAS Nuclear Propulsion Conference, 17 August 1962. Howarth, W. L.; Retallick, F. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Apr 1963. 22p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

A typical curve of decay heat power for the NERVA reactor after operation at full power for 20 minutes and for the instantaneous insertion of 4.5 dollars of shutdown reactivity is found to vary from about 20.0 to 5.0×10^{-4}, the latter figure being the amount of heat which can be radiated to space from the engine exterior surfaces. One method of decay heat cooling is to cool the reactor at as high a constant core exit temperature as possible with just sufficient coolant to remove the heat being generated. In this scheme the cooling flow is directly proportional to decay power. Thus, the variation in power from 20.0 per cent to 5.0×10^{-4} percent also applies to the coolant flow. Difficulties with such a system at low flow rates have resulted in the consideration of the pulse system, where the coolant is injected at reasonably high flow rates for short time durations. Cooling begins whenever a temperature limit in the reactor is reached and continues until a predetermined lower temperature is reached. At this lower temperature, cooling is stopped and the temperature allowed to rise due to the decay heat until the upper temperature limit in the reactor is again reached. The performance of such a system is dependent on the lower temperature to which the reactor system is cooled during the pulse. Increased differences between it and upper temperature limit result in greater usage of coolant and lower specific impulses of the coolant. Smaller temperature differences increase the system performance, but at the cost of system reliability because of the larger number of pulses. The selection of the temperature difference must be a compromise between performance and system reliability. (auth)

23749 (WANL-TME-259) REACTOR TEST PROGRAM TASK FORCE: MEETING AT WANL, JANUARY 21–23, 1963. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1963. 149p. Dep. NTIS $10.50.

Declassified 10 Sep 1973.

The designs of the early NRX and the later KIWI reactors and of their major components were reviewed with the aid of graphs and diagrams which have been documented. (LTN)

23750 (WANL-TME-262) SHIELDING IN THE NRX TEST CAR PRIVY ROOF. Ricks, L. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Feb 1963. 6p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

An analysis was made of the adequacy of the privy roof shielding (1) to limit the integrated gamma dose at the control drum actuators to 5×10^6 Rad during a full power NRX run and (2) to limit the dose rate on the roof to less than 7 mr/hr after 30 days decay and with the roof filled with water. It was determined that the shielding was adequate for these purposes. Recommendations for modifications to reduce the capture gammas, radiation heating and activation of the iron were also made. (LTN)

23751 (WANL-TME-268) COMMENTS ON PROPOSED LASL LN_2 SYSTEM. Kutilek, J. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Feb 1963. 5p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The 200°R gaseous nitrogen system proposed by LASL for test cell "A" is criticized as being inadequate for cooldown requirements after a 20 minute full power reactor test. The requirements for a liquid nitrogen system which would match the capability of the expanded liquid hydrogen storage are specified and justified as to usage (cooldown, room inerting, vent stack). (LTN)

23752 (WANL-TME-273) NUCLEAR ANALYSIS OF NRX-A. Faught, H. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1963. 102p. Dep. NTIS $8.25.

Declassified 11 Sep 1973.

The analysis leading to the NRX-A central zone fuel loading specifications and a tentative peripheral zone fuel loading specification is presented. The criteria for the reactivity and power distribution in the NRX-A reactor were first derived. A fuel loading meeting these criteria was then developed using LASL experimental data for KIWI B-4A and analysis. The way in which these requirements have been combined to set the loading is described. (auth)

23753 (WANL-TME-279) RECOMMENDED MODIFICATIONS TO EXTEND TEST CELL "A" CAPABILITIES FOR NRX TESTING. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Mar 1963. 47p. Dep. NTIS $5.50.

Declassified 21 Jul 1975.

Modifications required of the Test Cell "A" facility to meet the demands placed upon it by the NRX tests are described. Since both schedule and available budgets are limited, the evaluation of needed modifications to the existing facilities was made considering the following: Modifications required for the NRX-A1 cold flow test in September, 1963; modifications required for the NRX-A2 hot test in December, 1963; and modifications recommended to increase reliability. The third category would be accomplished only as the schedule and budgets would allow. Since it is probable that the exact run profiles of NRX-A1 and NRX-A2 will not be firm for several months, the proposed modifications are based on the best known current information and projected by engineering judgment to provide a facility capability that allows some latitude in test capabilities. (auth)

23754 (WANL-TME-288) NRX-A SHORT RUN FLOW PROFILES AND COOLANT USAGE FOR TEST CELL A. Howarth, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Mar 1963. 11p. Dep. NTIS $4.00.

Declassified 17 Jul 1975.

Preliminary estimates were provided for the normal reactor cooldown usage of liquid hydrogen, gaseous hydrogen and gaseous nitrogen over their applicable time ranges up to 24 hours after shutdown after 2,3,4, and 5 minutes equivalent full power operating times. This information will enable ground support engineering to determine the maximum operating time consistent with the present test cell "A" tank farm capacity and the proposed shutdown schedule. (LTN)

23755 (WANL-TME-292) NRX-A CYCLE SCHEMATIC DIAGRAM. Thomas, G. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Mar 1963. 3p. Dep. NTIS $4.00.

Declassified 21 Jul 1975.

23756 (WANL-TME-293) REACTIVITY FEEDBACK LIMITATIONS ON OPERATION. Thomas, G. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 13 Mar 1963. 4p. Dep. NTIS $5.00.

Declassified 21 Jul 1975.

Calculations of the reactivity effects resulting from the presence of hydrogen in the core and reflector as well as the reactivity effects associated with core materials expansion and doppler effects are presented. It was decided to tentatively limit the permissible net positive reactivity feedback due to the presence of hydrogen and core temperature above 540°R to 1.0%. If the core is adjusted to a cold, clean shutdown reactivity of 3.5 dollars and a minimum of 2.0 dollars are allotted to scram requirements, the remaining 1.5 dollars (~ 1%) is available to reactivity feedback. The T_c and P_c conditions necessary to yield this feedback are shown on a plot. The results are approximate in the lower regions of the map, where steady state engine operation would not generally be expected. Since this region is normally traversed in the startup transient, the rate of startup would influence the reflector cooldown rate and the hydrogen density in the core and reflector. An approximate startup path for a 100°R/sec startup transient with good tie-rod performance is shown for comparison. The cooldown path would normally fall to the left of the startup path. Since the net reactivity is the algebraic sum of positive and negative contributions, the results must be qualified with the understanding that future analyses of the reactivity coefficients could influence the results. (auth)

23757 (WANL-TME-296) HEAT GENERATION RATES IN THE NRX ALUMINUM PRESSURE VESSEL AND SUPPORT STAND WITH THE ALUMINUM MOCKUP SHIELD. Capo, M. A.; Nassano, R. N.; Stephenson, L. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Mar 1963. 6p. Dep. NTIS $4.00.

Declassified 21 Jul 1975.

Total heating rates at various detector points in the NRX aluminum pressure vessel and support stand with the NRX shield replaced by an aluminum mockup shield containing coolant holes have been calculated and are presented. A geometrical layout of the NRX assembly is given to facilitate the location of the pressure vessel detector points. These heating rates include contributions from the core gamma rays, neutron slowing down (kinetic heating), and gamma rays produced by neutron capture and inelastic scattering in the aluminum shield and core support plate. Iso-heating rate curves in the vicinity of the test stand are also presented. (auth)

23758 (WANL-TME-297) POWER GENERATION AND DISTRIBUTION IN NRX-A-1; BURNUP OF ^{235}U IN NRX-A-1. Speis, T. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Feb 1963. 13p. Dep. NTIS $4.00.

Declassified 21 Jul 1975.

The absolute power and flux distributions, and burnup of U-235 in NRX-A1 are required to facilitate the design of irradiation experiments and as reference data. The methods by which these parameters have been calculated are described briefly and the values are reported. The average power generated in the NRX-A1 core is 2360 watts per cc of fueled graphite; the maximum power is 3993 watts per cc of fueled graphite. The average burnup of U-235 in one minute of operation at 1165 MW power is 1.238 grams; of this quantity 0.846 grams are fissioned and 0.392 grams are destroyed due to n,γ reaction. The maximum burnup of U-235 (% consumed in one minute of maximum power operation) occurs at the core-reflector interface and is 2×10^{-3}%. The maximum burnup at the center of the core is 1.08×10^{-3}%. It will require a thermal neutron flux of $(3.64-6.16)10^{14}$ to duplicate NRX-A1 conditions in a test reactor. (auth)

23759 (WANL-TME-301) TABULAR DATA FOR KIWI B-4A AND KIWI B-4B. Barksdale, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Jan 1963. 23p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

Since the first NRX reactor will be similar to the Los Alamos KIWI B-4 series, it is desirable that all experimental results pertaining to KIWI B-4 reactors be tabulated, in order to provide an additional level of confidence in the design of NERVA reactors. The data presented is a compilation of experimental results taken from Los Alamos N-2 Reports, Trip Reports, and personal contact with Los Alamos personnel with regard to the KIWI B-4A, ZEPO B-4 and KIWI B-4B reactors. (auth)

23760 (WANL-TME-308) PRELIMINARY INVESTIGATION OF NRX-A CORE ELEMENT INTERSPACE VOIDS AND THEIR DISTRIBUTION. Eppley, C. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 May 1963. 37p. Dep. NTIS $5.00.

Declassified 21 Jul 1975.

A preliminary investigation has been carried out to determine the NRX-A core interspace voids and their distribution by building a reactor core on paper and comparing the areas of the theoretical geometrical shapes with the summations of areas of the elements they enclose. The area differences are representative of the void and flow area in each elementary geometrical shape considered. The lengths of the legs of the equilateral triangles

involved are compared to determine the bridging dimensions. (auth)

23761 (WANL-TME-332) PRELIMINARY MEASUREMENT OF ORIFICE COEFFICIENTS FOR PRODUCTION TYPE FUEL ELEMENT ORIFICES. Fix, H. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Apr 1963. 19p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The results of preliminary tests on production type fuel element orifices are summarized. The areas investigated were: the flow-pressure drop characteristics as a function of diameter and operating conditions; and the variation in orifice loss coefficient as a function of Reynolds number. Tests were conducted on 50 mil and 60 mil production fuel element orifices using hydrogen gas at inlet pressures of 320 psig and 660 psig and at ambient and cryogenic temperature. It was concluded that: good correlation is obtained for flow and pressure drop characteristics of two identical orifices tested at the same conditions; and the loss coefficient varies slightly with Reynolds number for large values of Reynolds number (100,000). It is recommended that future tests be conducted with a more closely controlled inlet temperature, and that a more sensitive gauge be installed to measure low pressure drops and minimize experimental errors. (auth)

23762 (WANL-TME-361) NRX TEST PROGRAM: NUCLEAR TEST REQUESTS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1963. 53p. Dep. NTIS $5.75.

Declassified 16 Jul 1975.

Requests are presented for nuclear tests (nucleonics, radiation, and shielding) that the Reactor Analysis Department desires to have performed on the NRX-A-2 reactor and other Block 1 reactors at NTS. The principal purpose of these requests is to define the information needed in the form of the test objective. Also included are the test justification, references, brief discussion of hazard considerations, outline of suggested test procedure, and data requirements. The overall purpose of the nuclear tests is to: Determine the important nuclear characteristics and confirm the nuclear design during startup, operation at power, and cooldown; determine dose rates and heating rates outside the reactor in order to substantiate the design and provide firm radiation environment data; and provide information useful for future NRX reactor and shield design and for nuclear methods development. Twelve tests are discussed in detail. (auth)

23763 (WANL-TME-375) HIGH TEMPERATURE FUEL IRRADIATION BEHAVIOR EXPERIMENTS: CAPSULE SERIES WANL-TT. Tobin, M.; Allen, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 May 1963. 28p. Dep. NTIS $4.50.

Declassified 22 Jul 1975.

The purpose of this planned series of six capsule irradiation experiments is to evaluate the macro and micro-structural changes which occur in the fuel during high temperature irradiation. A secondary objective is to measure the thermal conductivity and thermal stress resistance of the fuel during irradiation. The principal variable, in the fuel which will be irradiated in each capsule, will be in fuel loading and fuel structure. The general sequence of the experimental work will be: pre-irradiation evaluation of the fuel including its micro-structure; irradiation at three increasing temperatures up to 2400°C during which temperature and temperature gradient data will be taken; hot-cell disassembly of the stainless steel capsule; shipment of the graphite cartridge containing the fuel pellets to WTR Hot-Cell; examination for changes in the fuel dimensions, density, macro and micro-structure. (auth)

23764 (WANL-TME-383) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY OPERATING LIMITS. Ney, E. J.; Barksdale, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Sep 1963. 19p. Dep. NTIS $4.00.

Declassified 21 Jul 1975.

Westinghouse Astronuclear Experimental Facility operating limits for performance of NERVA nuclear experimentation are presented. (auth)

23765 (WANL-TME-396(Rev.A)) PRELIMINARY MODEL SPECIFICATION NERVA NUCLEAR SUBSYSTEM MODEL NRX-A FOR ENGINE, ROCKET, NUCLEAR, SHIELDED, HOT-BLEED, MODEL No. AJ30-5. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1963. 94p. Dep. NTIS $7.75.

Declassified 14 Jul 1975.

The Nuclear Subsystem is a hydrogen-cooled, graphite-moderated, intermediate neutron energy reactor. The bulk of the performance data given applies to Block 1 reactors with the aluminum shield. It is designed to supply the AJ30-5 engine nozzle with 71.6 lbs/sec of hydrogen at 4090°R and 550 psia as well as bleed flows for turbine drive, tank pressurant, pneumatic actuation and components coolant. The Nuclear Subsystem consists of the following assemblies: The core assembly consisting of many clustered graphite – uranium fuel elements supported axially from the dome end by cooled metal tie rods and bundled radially by the graphite inner reflector and its lateral support structure; the outer reflector assembly consisting of twelve beryllium segments, each having a longitudinal hole for a beryllium control drum, and the control drums each containing a boron-aluminum poison element; the shield assembly consisting of capsules containing lithium hydride plugs, boron-stainless steel plugs, and stainless steel; the screen assembly; the anti-criticality poison system consisting, in part, of tubes containing boron which are inserted into the fuel coolant channels from the core exit end; and the reactor control system to be used in conjunction with the engine controls and engine programmer to position the control drums during startup, full power, shutdown and restart. (auth)

23766 (WANL-TME-399) SUMMARY SCREENING REPORT ON CHEMICAL DESTRUCT SYSTEM. Roll, J. A.; Vollmer, R. M.; Wilks, P. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1963. 20p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Following operation of the NERVA core, it is desirable to minimize the deposition of fission products in the earth biosphere. One means of accomplishing this objective is to degrade the core into small particles which will have long residence times above the biosphere and/or high rates of fission product loss during re-entry. Were this accomplished by the introduction of a reactive chemical into the core, uniformly small particles of zero velocity vector would be produced. These are two highly desirable criteria, not readily satisfied by the other types of destruct systems under consideration. Moreover, a chemical destruct system would be relatively immune to radiation damage. An extensive laboratory screening program has examined theoretically promising reagents from the standpoint of their reactions with fueled materials at temperatures from 20-2450°C. Extrapolation of the data obtained results in the rejection of most reagents because of the high weight requirements for complete reaction with the core. The interhalogens hold some promise of core degradation with modest weights of reagent because of their combined action as fluorinating agents and their ability to form interstitial compounds with graphite. Of the interhalogens tested, chlorine trifluoride has proven to be the most promising, having accomplished complete specimen degradation at 240°C with an amount of ClF_3 equal to only 25% of the specimen weight. The capabilities and requirements of a destruct system employing ClF_3 are discussed. (auth)

23767 (WANL-TME-407) STRESS ANALYSIS: NRX-A FUEL ELEMENTS. Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 111p. Dep. NTIS $8.75.

Declassified 10 Sep 1973.

An elastic stress analysis of the regular fuel elements in the NRX-A core is presented. Included are analyses of the stresses caused by the internal heat generation, the temperature differences between adjacent elements, the effect of bundling pressure and the inlet band, the pressure drop through the core, the bending of the outer fuel elements to follow the curvature of the core surface caused by the axial temperature distribution, and the temperature gradient in the outer elements due to coolant leakage along the outside. After these individual stresses are calculated, the probability of element survival under various combinations of these stresses is determined. Finally, a statistical distribution of the fuel element temperatures about the mean operating temperature is used to compute a "probability of survival" for the entire core. The "probability of survival" is the probability that no elements in the entire core will crack under steady state operating conditions. These probabilities assume there is no coolant leakage into the core through the filler strips. However, since the possibility of leakage does exist, the effect that leakage would have on element and core survival probabilities is also shown. (auth)

23768 (WANL-TME-414) ALTERNATE PLAN FOR NRX REACTOR ASSEMBLY AT NRDS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jun 1963. 9p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The recommended method of NRX reactor assembly has been identified as shop assembly of the reactor at the Large, Pennsylvania facility and shipment of the assembled reactor by rail, truck or air to the NRDS site for incorporation into the NRX test car. This memorandum has been prepared to identify a backup

program in the event the early NRX-A reactors must be shipped disassembled to the Nevada Test Site and assembled there prior to incorporation in the test car. This memorandum identifies the facility recommended for the assembly, the general plan for the operation, and the estimated cost and schedule. This plan has been developed on the assumption that assembled reactors would ultimately be shipped from the Large site but for a limited number of early reactors it may be necessary to provide an assembly capability in Nevada. (auth)

23769 (WANL-TME-415) PROGRAM TO DEMONSTRATE CAPABILITY OF SHIPPING NRX-A REACTORS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Jul 1963. 12p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The WANL program for demonstrating the feasibility of shipping assembled reactors is presented. Analysis of the shipping loads imposed on the reactor when mounted in a properly designed shipping container indicated that these loads would normally be quite low and relatively small compared to the dynamic loads for which the NRX-A reactor was designed. These facts, when coupled with the important advantages of shop assembly of the reactor, (contrasted to field assembly) led to a WANL recommendation that NRX-A reactors be shop assembled and shipped to the test site as integral assemblies. Detailed analyses of shipping safety considerations; assembly methods; assembly critical experiment requirements; shipping container design; shipment plans; and quality control plans have been presented. A demonstration shipment of a simulated reactor package that is fully instrumented to record all imposed loads is proposed. (auth)

23770 (WANL-TME-418) SEATING OF NRX-A CORE PERIPHERY SEALS BY ANGLED LATERAL SUPPORT PLUNGER. Pianka, E. W.; Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 18p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

There can be no positive assurance that all of the NRX-A core peripheral seals will seat with only the pressure drop as the driving force. The incorporation of a positive angle on the seal contact area of the lateral support plunger will provide the required force to seat the seal. (auth)

23771 (WANL-TME-422) UNSEATING OF NRX-A INNER REFLECTOR AND CLUSTERS. Pianka, E. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jul 1963. 27p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

The maximum bundling pressure that can be exerted on the core and the critical combination of system pressure drops to cause the inner reflector to lift off from the nozzle are determined. This lift off can only occur if there is relative motion between the reflector and the nozzle. The bundling pressure which will prevent relative axial motion between the fuel elements or clusters is also determined. (auth)

23772 (WANL-TME-422A) UNSEATING OF INNER REFLECTOR AND CLUSTERS (REVISION A). Pianka, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1964. 36p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The minimum force acting at the inner reflector-nozzle interface is determined for the reactor operating at its steady-state, full power condition. The analysis shows that even for the "worst possible" combination of system parameters a net compressive force exists at the nozzle interface, indicating that separation cannot occur. The analysis used in substantiating this conclusion is conservative in that compensating strains produced in the components have been neglected. In addition to the lift off problem, the amounts of bundling pressure which can be exerted before friction causes the fuel elements to hang up on adjacent elements and a circumferential row of clusters to hang up on the filler strips are determined. (auth)

23773 (WANL-TME-426) REACTOR NON-FUEL MATERIALS PROGRAM, CY 1963 AND CY 1964. Lorenz, F. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Jul 1963. 58p. Dep NTIS $6.00.

Declassified 10 Sep 1973.

Efforts have been concentrated on the preparation and issuance of urgently needed material and process specifications; consultation with design, manufacturing, quality control and purchasing personnel in the selection of materials; acquisition of materials properties data for the NERVA Materials Manual; liaison with suppliers; and the initiation of planning for the non-fuel materials development program. Some critical materials (pyrolytic carbon, graphite, titanium, beryllium, stainless steels with neutron absorbing additives and alloys for tie rods) received special attention with respect to specifications, fabrication methods, properties evaluation, properties improvement, radiation effects, etc. Anti-galling coatings for titanium bolts were investigated. (auth)

23774 (WANL-TME-432) FURTHER ESTIMATE OF HYDROGEN CORROSION OF GRAPHITE. Goodman, E. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Jul 1963. 22p. Dep. NTIS $4.25.

Declassified 14 Jul 1975.

An initial estimate of graphite corrosion rates in flowing hydrogen was presented previously using data from unlined, fueled graphite. Since that time additional data have become available on unfueled graphite as well as the effect of gap size on corrosion rate. In addition, the following factors were not considered in detail in the initial estimate: Pressure, hydrogen velocity, hydrocarbon concentration in hydrogen, and radiation (nuclear). It is the purpose of the present work to apply the latest corrosion data and investigate the above factors in more detail. (auth)

23775 (WANL-TME-437) REVIEW OF SAFEGUARDS AGAINST ACCIDENT CRITICALITY IN WANL REACTOR ASSEMBLY AREA. Dominey, S. C.; Hemmerle, E. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1973. 93p. Dep. NTIS $7.75.

Declassified 10 Sep 1973.

The safeguards which have been included in the facilities design and operating procedures to insure against accidental criticality during NERVA reactor assembly by Westinghouse at its Astronuclear Laboratory located in Large, Pennsylvania are reviewed. The facilities to be used for this assembly have been constructed recently and will be used exclusively for this work. The area is subdivided into two major areas, one to be used for the final assembly of components and the other for fuel storage and fuel cluster assembly. The reactor assembly area is completely isolated. Access is restricted and it is under constant security surveillance. Heating and ventilation are handled by a separate system. All water lines have been removed from the areas in which fuel is handled. Fire detectors and criticality alarm monitors are installed throughout. The flow of fuel material for reactor assembly is described including the principal procedures used to control the flow and storage of material in process. The Criticality Control Procedures established by the Reactor Assembly Group are given. The principal safeguards against accidental criticality during fuel storage and reactor assembly are the use of equipment such as the storage shelves in the fuel vault which physically limit the amount of fuel, exclusion of water from the areas and the use of the shipping poison wire system. As indicated, relatively large quantities of fuel can be safely handled and stored under conditions which exclude water. Both storage areas in building 6 were designed to exclude water and the safe storage arrays were established on this basis. Although these storage arrays do not meet the usual criteria for safe storage under flooded conditions, it is expected that the arrays will be subcritical when flooded but with only a marginal degree of safety. The primary function of the shipping poison wire system is to safeguard against criticality in the event of accidental flooding of the complete reactor during shipment. Since the poison wires are installed during fuel cluster assembly, they also provide a large margin of safety during subsequent fuel cluster storage and reactor assembly. The reactivity shutdown margin of the assembled reactor will be greater than $30. (auth)

23776 (WANL-TME-450) TWELVE SIDED NRX-B DESIGN. Doncals, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Jul 1963. 16p. Dep. NTIS $4.00.

Declassified 16 Jul 1975.

The nuclear feasibility of an NRX-B core in which radial thermal expansion was accommodated internally has been investigated. This was accomplished by wrapping graphite felt around each individual element. The felt is then compressed during assembly resulting in a tightly bundled reactor, desirable from a shock and vibration standpoint. Thermal expansion during startup is accommodated by further compression of the felt. Instead of the conventional circular arrangement, a twelve sided core configuration was analyzed. The core was sized to provide the same power rating as the conventional NRX designs. The graphite reflector region was eliminated completely, its place being taken by a beryllium reflector of increased thickness extending outwards to the pressure vessel and accommodating large diameter (5.25") control drums. (auth)

23777 (WANL-TME-464) GRAPHITE SUPPORT PLATE PRESSURE DROP. Cerni, S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Aug 1963. 5p. Dep. NTIS $4.00.

Declassified 16 Jul 1975.

One of the advanced reactor concepts utilizes a graphite support plate at the hot end of the core. For structural purposes, the plate has an approximately spherical exit surface and seats on peripheral surface which is 45° to the core axis. Due to this arrangement, there is more surface area at the plate inlet than at the outlet and in order to achieve more uniform ligament thicknesses between coolant passages, it is convenient to taper these passages. In addition, the peripheral passages are longer than the central ones. In order to have the minimum effect on flow rates in the fuel element channels, the pressure drop across each support plate channel should be the same. This can be accomplished by varying the inlet and outlet diameters. To simplify the manufacturing process the taper angle of all the passages should be the same, enabling usage of the same reamer. In general, a passage in the support plate is fed by a single 19 hole fuel element. Partial fuel elements containing 12 channels have been used at the periphery where possible. These require a special channel in the support plate. The support plate channel fed by a 12 channel partial fuel element should taper from .32 in. diameter at inlet to .259 in. diameter at exit. It was found that the magnitudes of the pressure losses calculated are very sensitive to small changes in channel diameter. It appears that normal manufacturing tolerances will have some effect on the pressure drop. A one mil deviation in channel dimension will change the pressure drop through the plate by approximately .7 psi. Variations in channel diameters will probably have to be accounted for in the orificing of the fuel element channels. (auth)

23778 (WANL-TME-471) NRX/A SHIELD REPLACEMENT UNIT, STRESS AND VIBRATION ANALYSIS. Gundeson, C. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 51p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

A design description of the aluminum replacement unit is presented as well as the supporting stress and vibration analysis. The nuclear function of the lithium hydride shield did not apply for the aluminum replacement unit; thus, considerable simplification was possible in the design of the aluminum replacement unit. (auth)

23779 (WANL-TME-472) EXPERIMENTAL DETERMINATION OF ORIFICE COEFFICIENTS FOR PRODUCTION TYPE FUEL ELEMENT ORIFICES FOR NRX-A1. Fix, H. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Aug 1963. 35p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

The results of tests on production type fuel element orifices are summarized. The areas investigated were: The variation in loss coefficient as a function of Reynolds Number for a particular diameter orifice; and the variation in loss coefficient as a function of orifice diameter for the operating Reynolds Number range. Tests were conducted on production fuel element orifices using hydrogen gas at inlet pressures of 320 psig and 660 psig and at ambient and cryogenic temperature. Twelve orifice sizes ranging from .070 to .0225 mils nominal diameter were tested. It was concluded that: For large values of orifice diameter to cluster plate diameter, and low flow rates, the loss coefficient is dependent on and decreases with increasing Reynolds Number; for high flow rates, the loss coefficient is dependent on and increases with increasing Reynolds Number due to compressibility effects; and for the design reactor flow rates and conditions, loss coefficient is independent of Reynolds Number. Further investigations should be conducted into the following: A correlation of orifice diameter to cluster plate diameter ratio, Reynolds Number and loss coefficient; a correlation of Mach Number, Reynolds Number and loss coefficient; and the effect of axial and radial cluster plate position on loss coefficient. (auth)

23780 (WANL-TME-478) ALTERNATE METHODS OF INVESTIGATING FLOW INDUCED VIBRATIONS. DeZubay, E. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1963. 27p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

This summary on various flow-induced vibration tests considers the four major types of tests which could accomplish, in part or in entirety, the experimental verification of design concepts for the support system for the NRX-A design. Requirements of the tests are discussed and alternate methods and schedules are being considered. On the basis of technical desirability as well as schedule requirements, firm recommendations are presented. (auth)

23781 (WANL-TME-482) ANALYTICAL INVESTIGATION OF THE SHOCK CAPABILITIES OF THE NRX-A SUPPORT SYSTEM. Scialdone, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 29p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

The lateral dynamic forces of a shock nature which can be applied to the NRX-A reactor core without exceeding the design criteria are determined. These shock inputs, qualified by their magnitudes, durations, and shapes are established on the basis of the NRX-A design criteria of maximum allowable lateral deflection and g loading on the core. The response of the reactor core to the shock inputs is determined for three damping conditions: no damping, viscous damping, and coulomb damping. Viscous damping which represents the resistance encountered by a body moving through a viscous fluid has been assumed to exist in and around the reactor core. However, since the exact amount of viscous damping is not known, the effect of damping between 0 and 100 percent of the critical has been included in the analysis of the shock response. The effects of coulomb damping (friction or the sliding of dry surfaces) with respect to the core capabilities to withstand lateral shock have been determined for a particular value of coefficient of friction. The results indicate the following: About 30 percent of the critical viscous damping would allow the maximum acceptable shock to be applied to the core, which viscous damping higher than 50 percent of the critical damping would decrease the shock capability. Coulomb damping (frictional damping) increases the shock capabilities of the reactor core. Pulses of durations less than 20 milliseconds will be attenuated while pulses of durations greater than 20 milliseconds will be magnified. (auth)

23782 (WANL-TME-488) NRX-A DESIGN REVIEW. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jul 1963. 265p. Dep. NTIS 16.25.

Declassified 10 Sep 1973.

Reports on various features of NRX-A reactor design given at a design review meeting have been documented. (LTN)

23783 (WANL-TME-489) RECLAMATION OF BERYLLIUM SCRAP. Harrod, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Aug 1963. 26p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

An investigation has been conducted to establish the technological and economical feasibility of using AEC-owned beryllium scrap as source material for NERVA beryllium requirements. It has been established that reclamation is technically feasible and that it will be necessary to exert only a few minor controls on the reclamation process in order to insure maximum integrity of the finished product. There are indications that substantial money savings might be realized via reclamation of the scrap; however, the actual savings that might be realized can be ascertained only by requesting bids on specific proposals. (auth)

23784 (WANL-TME-492) EFFECT OF TIE ROD RESISTANCE ON CORE BUNDLING OF BANDED AND UNBANDED NRX-A CORE DESIGN. Downs, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1963. 21p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

The relative ability of the banded and unbanded core designs to keep the core elements bundled against the tie rod resistance is compared. (auth)

23785 (WANL-TME-494) FACTORS INVOLVED IN THE ELIMINATION OF THE FUEL ELEMENT ALIGNMENT SLEEVES. Arnold, W. H. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Aug 1963. 4p. Dep. NTIS $4.00.

Declassified 16 Jul 1975.

The decision to remove the alignment sleeves on NRX-A1 and NRX-A2 was made on the basis that the sleeve as designed was insufficiently strong to withstand the types of loads encountered in KIWI B-4A — indeed they seemed to be susceptible to failure even in normal handling. Subsequent to failure, or even as a result of minor chipping, they would provide a focal point for catastrophic corrosion due to loss of coating. The sleeves, had they remained intact, would have limited the maximum mismatch of fuel element and support block coolant holes due to relative rotation of the support block and the fuel element cluster to an approximate value of 14.5 mils. A preliminary estimate of the corresponding value without the sleeves is 26.5 mils, based only on rotation of the support block into contact with its neighbors. In calculating the performance effects of such misalignments, it is necessary to combine the expected distribution of such block rotations with the statistical variation of hole location in the fuel elements (12 mils maximum) and the support blocks (1.5 mils maximum). When such distributions are available, one then combines the probability distribution of given degrees of mismatch with the corresponding hot channel temperature penalty, the resulting temperature distribution is then folded with similar distributions of other off-design conditions leading to higher temperatures. A preliminary analysis performed for the present situation shows that the max-

imum coolant channel outlet temperature rise caused by the 28 mil (14.5 + 12 + 1.5) misalignment possible without the pins is 308°R; the corresponding value for the 40 mil case is 794°R. It must be emphasized that: actual misalignments are distributed between zero and its maximum value; other factors are involved; radial heat conduction is not allowed for; and periphery channels (high power channels) will have smaller misalignment factors. Also, the results are considered preliminary estimates of the possible temperature rise. (auth)

23786 (WANL-TME-498) REVIEW OF NERVA PARAMETERS AND REACTOR EXPERIMENTS. Gallagher, J. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Aug 1963. 32p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

As a result of the review, a list of all important NERVA nuclear parameters and their end use in NERVA has been made. The criticality of these parameters is indicated by classing each according to whether experimental verification is required prior to the operation of each reactor or required to permit NERVA to meet its full performance requirements and maximum capability. The experimental verification of these parameters can be provided by a family of experiments which are described and related to each nuclear parameter. (auth)

23787 (WANL-TME-502) HIGH TEMPERATURE TESTING OF PREPRODUCTION FUEL ELEMENTS. Foster, R. D.; Burghardt, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Sep 1963. 50p. Dep. NTIS $5.50.

Declassified 10 Sep 1973.

Fuel elements were tested under environmental conditions simulating those encountered during reactor operations in order to study their behavior. The equipment used to obtain the simulated conditions, the developmental evaluation of some of the test components and the operation of the equipment are discussed. Typical nineteen-holed elements made of pure graphite, beaded natural uranium–graphite mixture, and enriched uranium–graphite mixtures were tested. The determination of the adequacy of the niobium–carbide coating for minimizing the hydrogen–carbon reaction was the main objective of each test, with pressure drop and heat transfer data being obtained whenever possible. The results indicated an element weight loss due to hydrogen corrosion of the order of 5.0 grams during a five minute test at 4500°R element surface temperature and 550 psia hydrogen pressure at the exit of the element. In general, the elements exhibited very little dimensional change, but in tests in which axial expansion was restricted the element developed a considerable amount of bowing and a permanent set in the bowed configuration. Test results indicated an axial expansion of approximately $\frac{3}{8}$ inch when the element was heated over a 4000°F temperature difference. (This corresponds to a coefficient of thermal expansion of approximately 2×10^{-6} in./in.-°F). (auth)

23788 (WANL-TME-505) FEASIBILITY STUDY OF REPETITIVE SPATIAL INTEGRATION TECHNIQUES AS APPLIED TO A TYPICAL NERVA REACTOR. Burski, P. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Aug 1963. 27p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

Initial exploration studies into the technique of solving the partial differential heat transfer and flow equations, describing a typical NERVA reactor core, through the use of repetitive spatial integration are reported. The application of this technique produces analog computer solutions as continuous functions of a space variable, axial core distance, as opposed to conventional analog simulations which normally simulate reactor core variables as continuous time functions. The feasibility of repetitive spatial integration is being investigated as it has definite advantage over conventional methods. The mathematical model is able to incorporate physical parameters as functions of the core axial geometry rather than using "lumped" averages necessary in the conventional approach. Since the repetitive spatial integration model is able to describe the physical system more accurately, it should result in a truer simulation of actual reactor dynamic behavior. In addition, it provides more information. Besides producing core variables as discrete functions of time at the reactor exit, the internal temperature and pressure axial distribution profiles are simulated continuously. Repetitive spatial integration requires function storage which can best be accomplished by using "hybrid" computation, a computation utilizing digital and analog equipment. The preliminary study demonstrates the feasibility of applying repetitive spatial integration techniques to reactor simulations and indicates the potential for quantitative applications. Further development is recommended using a hybrid computer system. (auth)

23789 (WANL-TME-508) WANL FLEXIBLE CRITICAL EXPERIMENT (FCX) DESIGN REPORT. Barksdale, C. E.; Ney, E. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 36p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The successful development of a particular nuclear reactor requires that nuclear characteristics be well understood in order that design changes or design requirements can be properly assessed. This understanding of nuclear characteristics is best accomplished by performing a series of critical experiments and comparing the experimental results with predictions based upon various analytical models. The goal is the development of an analytical system which can be used with confidence in evaluating reactor nuclear properties. Conceptual considerations, both nuclear and mechanical, are provided for the WANL Flexible Critical Experiment (FCX) that would provide an inventory of basic nuclear data required to establish and verify analytical design procedures for nuclear design of NERVA Program reactors. (auth)

23790 (WANL-TME-515) METALLURGICAL ASPECTS OF THE REUSE OF BERYLLIUM REFLECTORS. Harrod, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Sep 1963. 25p. Dep NTIS $4.25.

Declassified 11 Sep 1973.

A review of the available information and data on the chemical, physical, and mechanical properties of beryllium has established that there are no materials problems which will limit or prevent the reuse of beryllium reflectors. Electrolytically refined beryllium represents the highest purity grade of beryllium available on a commercial basis and an adequate supply of this material is available for NERVA requirements should the composition typified by this material be suitable for reuse from an induced-activity level consideration. The available data on irradiation effects indicate that for the irradiation environment anticipated for NERVA reflectors, irradiation damage will not be a significant problem. The beryllium reflectors being used in the NRX-A1, 2, 3, and 4 test reactors should be evaluated for purposes of establishing destructive and non-destructive testing requirements for future reflectors prior to their reuse. (auth)

23791 (WANL-TME-518) ANALYSIS OF AXIAL STATIC LOADS IN THE NRX-A REACTOR. Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1963. 44p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

The axial forces present in the NRX-A reactor system are evaluated. The paths traveled by the various loads from their point of application to the pressure vessel containing the reactor are traced. Specifically, the analysis considers pressure drop, weight, friction, flow shear, and spring forces. Minimum and maximum values for the forces carried by the various structural members are included. (auth)

23792 (WANL-TME-522) TEST SERIES A 7: EXPERIMENTAL DETERMINATION OF THE FRICTION FACTOR FOR THE FORMED TIE ROD LINER. Amatangelo, V. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1963. 14p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The results of flow tests on a production type helical tube liner and also a smooth tube liner are summarized. The areas investigated were: The variation in friction factor as a function of Reynolds number for the helical tube liner; the variation in friction factor as a function of Reynolds number for the smooth tube liner; and a comparison of the two friction factors as a function of Reynolds number. Tests were conducted on both the helical and the smooth tube liners in a fixture using hydrogen at 520 psig and 260 psig at ambient and cryogenic temperatures. Two tubes were used, one helical with an inside diameter of 0.234 inches and a pitch of 6.0, and one smooth with an inside diameter of 0.235 inches on a pitch of infinity. (auth)

23793 (WANL-TME-523) TEST SERIES C 1: EXPERIMENTAL DETERMINATION OF THE PRESSURE LOSS COEFFICIENT FOR THE IMPEDANCE RING IN THE INNER REFLECTOR-OUTER REFLECTOR ANNULUS. Amatangelo, V. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1963. 13p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The inner impedance ring primarily meters the flow in the annulus between the inner and outer reflector and permits the flow in the annulus to be balanced with the rest of the entire reactor system. The impedance ring minimizes the problems of temperature distribution by mixing hydrogen from the various paths. The results of a test on a 10° inner impedance ring sector are summarized: Over the operating Reynolds number range

the loss coefficient across the metering ring is constant; decreasing the flow area results in a greater loss coefficient and increasing the flow area results in a smaller loss coefficient for the same Reynolds number range; and for high flow rates, the loss coefficient is dependent on and increases with increasing Reynolds number due to compressibility effects. Further investigations should be conducted into the effect of annulus clearance on loss coefficient for the operating Reynolds number range. (auth)

23794 (WANL-TME-526) ANALYSIS OF WANL NRX-A EXPERIMENTS PERFORMED IN LOS ALAMOS ZEPO FACILITY. Kopp, L. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Sep 1963. 58p. Dep. NTIS $6.00.

Declassified 11 Sep 1973.

Experimental verification of the analytically determined reactivity worths of NRX-A type fuel material, poison shims, and positive shims is presented. Nuclear data is provided from cooperative experiments performed by Los Alamos and Westinghouse Astronuclear personnel in the ZEPO Critical Facility. (auth)

23795 (WANL-TME-528) ADVANCED TASK FORCE DESIGN REVIEW. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1963. 394p. Dep. NTIS $23.00.

Declassified 22 Jul 1975.

Major effort on the NRX-B design to date has been focused on the cooled bottom support plate concept. Two potential designs for the support plate (a brazed design developed at LASL, and a forged design developed at WANL) have been released for fabrication development and fabrication of test plates. Design of the lateral support system, transition blocks, and other hardware associated with this design concept has progressed to a significant degree. A component test program has been formulated and is in progress. Vibration problems encountered in the KIWI B-4A tests pointed up the structural problems which needed to be solved in the NRX-A design. Accordingly, the emphasis in the NRX-B program has been shifted to a search for new solutions to the design problems encountered in the NRX reactors. The program is now aimed at specifying the conceptual design of NRX-B in July, 1964. Examination of alternate design concepts will proceed as outlined, and each of these concepts will be evaluated in comparison with the NRX-A design and with previous effort on the cooled bottom support plate concept. Effort on the cooled bottom support concept will continue, but will not be the sole effort, nor will it be directed toward detailed design of the plate. The component test program outlined will be pursued to prove the feasibility of the cooled bottom support plate, and to evaluate its major problem areas. Additions to this program will be made as other concepts show promise, and as their problem areas become well defined. (auth)

23796 (WANL-TME-531) INTERIM REPORT ON ELECTRICALLY SIMULATED NUCLEAR TRANSIENTS. Bodenschatz, C. A.; Roll, J. A.; Rymer, G. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 26p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

The effects of nuclear transients on NERVA fuel are significant to the analysis of reactor excursions, to the feasibility of a nuclear destruct system, and to the physical limitations of reactor startup. A preliminary study was initiated by LASL in 1960, employing an electrical simulation of nuclear transients. Later, a joint LASL, Argonne National Laboratory, WANL program was undertaken to study these effects in the TREAT reactor. In view of the results and limitations of these programs, a series of high power, short transient, electrical heating experiments was performed recently at WANL. This involved the resistance heating of 7.5 inch samples of unfueled NERVA geometry graphite for transients of 16 to 100 milliseconds duration. The results are shown. The effective energies deposited into the samples ranged from 500 to 5600 cals/gram. The energy required to cause fragmentation was between 1700 and 2000 cals/grams. Plans for future work have been formulated. (auth)

23797 (WANL-TME-543) MEASUREMENT OF LOSS COEFFICIENT FOR THE BERYLLIUM REFLECTOR ASSEMBLY FLOW TESTS: TEST SERIES D 2. Bouille, J. R.; Morrison, H. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1963. 20p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Cooling of the beryllium reflector is effected by hydrogen flowing through a series of passages covering the entire length of the reflector. The hydrogen is introduced through holes in the lower support ring, flows through the reflector and is exhausted through holes in the upper support ring. The results of the flow tests on a segment of the beryllium reflector assembly are summarized. Hydrogen was used as the fluid medium instead of air as reported previously. The areas investigated were: (1) The effect of the hole size and geometry on pressure loss coefficients for the dome end and nozzle end support rings. (2) The effect of inlet and exhaust configuration on the pressure drop across the reflector. (3) The pressure distribution and flow patterns in the thin plena between the support ring and the reflector. These tests were made at maximum flows for the new high flow loop and really taxed the overall performance due to the high flow and limited supply of hydrogen. Also major difficulties were encountered in obtaining good flow of the coolant (liquid nitrogen) because of "off the shelf" control valve malfunctions. In view of the foregoing, it is recommended that selective tests be rerun at both ambient and cryogenic temperature with improved refrigerant control and a larger supply of liquid nitrogen. (auth)

23798 (WANL-TME-569) TASK 3.8 SPENT FUEL STORAGE AND COOLING REQUIREMENTS. Poindexter, A. M.; Kanaan, Z. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.) 15 Oct 1963. 35p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

Plans for the storage of NERVA reactor fuel after test, disassembly and post operative examination of an engine are reported. The conditions that are assumed to exist during storage and the limitations on fuel storage are stated. Calculations of fuel temperature in storage and WANL recommendations to insure that storage conditions are met are also presented. (auth)

23799 (WANL-TME-599) STRESS ANALYSIS: NRX-A CORE INLET BAND. Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1963. 30p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

New calculations and summarized previous analyses relating to the effect of the inlet end band are presented. They show that bundling pressure increases and a stiffer spring rate results when fuel elements are banded at the inlet end. This increased rigidity in bundling is desirable because it reduces the amount of leakage between the fuel elements and prevents fuel element vibration at the inlet end. The analysis shows that the maximum bundling pressure exerted by the band is 25 psi; this maximum pressure, which is encountered during a cold flow test, causes a hoop stress of 22,300 psi in the band material. The yield strength of the 5 Al-2.5 Sn titanium band at this cold flow temperature is over 140,000 psi. Under steady-state, full-power operating conditions the band will exert a maximum pressure of 15 psi, with an equivalent hoop stress of 13,400 psi and a yield strength at the operating temperature of 60,000 psi. Analysis also shows that the band does not tend to lock up the core at the inlet end. Under full-power, steady-state operational conditions, the band pressure is about 10 psi, but it acts on only 3.35 inches of the core, whereas the lateral support pressure acts on 52 inches. Evaluations have shown that the spring rate of the 0.020-inch thick titanium band is 1000 psi/in, which is much higher than that of the lateral support system and substantially increases the rigidity of the inlet end. This high spring rate increases resistance to fluid dynamics effects. Lastly, it was found that the band also limits the amount by which the tie rods tend to spread the core at the inlet end. When there is no band, the average space between the bundled elements tends to increase 0.00027 inch because of the spreading effect of the tie rods; with the band, the spread is only about 0.00002 inch. (auth)

23800 (WANL-TME-611) MATERIAL SELECTION FOR THE NRX-A CORE SUPPORT BARREL. McAndrew, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Dec 1963. 25p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

Information is provided concerning the selection of a material for the core support barrel in NRX-A reactors. The matter is discussed in terms of the functions which the barrel will perform, the barrel design, material property requirements for satisfactory performance, candidate materials, history of manufacturing experience, conclusions, and recommendations. Because of its good nuclear properties, high strength and ductility at temperatures from -423 to 600°F, good resistance to reduction in strength from exposure to high temperature, good weldability, high thermal conductivity, suitable thermal expansion coefficient and modulus of elasticity, commercial availability, and high strength-to-density ratio, the aluminum alloy 2219 is the material of choice for the NRX-A core support barrel. The best combination of properties for this application is obtained by post-weld solution treatment and aging to the T62 temper. Although some of the early test reactor builds in the NRX-A series do not require the optimum properties obtainable, it is recommended that barrels of 2219 aluminum alloy, post-weld solution-treated and aged to T62, be incorporated in the test program as early as possible so that data from early tests will be directly applicable to later reactors with restart requirements. Investigation of new alloys

such as 7039 and 7139, which are under development by the aluminum industry, and which may be applicable, should be continued. (auth)

23801 (WANL-TME-612) STRESS ANALYSIS: NRX-A REGULAR CLUSTER SUPPORT BLOCKS. Henne, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1964. 111p. Dep. NTIS $8.75.

Declassified 10 Sep 1973.

An analysis of the thermal and the mechanical stresses that occur in a regular cluster support block of the NRX-A Reactor during full-power, steady-state operating conditions is reported. One of the features of the NRX-A Reactor configuration is the use of the support blocks to retain the fuel clusters within the reactor core. In order to perform this function, the support block must be capable of withstanding the stresses caused by mechanical loads (weight of the cluster, spring preload, and force due to pressure difference) and stresses due to thermal gradients. While the complex geometry and the many coolant holes make it difficult to perform an exact analysis of the support blocks, their significance as a unit which must function properly for both the retention of the clusters and propellant exhaust makes a thorough analysis imperative. Therefore, in order to simplify the complexities and variables which cannot be positively analyzed, it is assumed that the block is a simple thick ring. Such an assumption makes the calculations manageable and analytically significant. The results of the stress analysis indicate that the regular support blocks should function adequately at the full power steady state operating condition. (auth)

23802 (WANL-TME-614) STRESS ANALYSIS: NRX-A1 DOME END SUPPORT RING. Pianka, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1963. 29p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

The Dome End Support Ring is used to attach the reactor to the pressure vessel and position it with respect to the pressure vessel and exhaust nozzle. Consequently, it is one of the primary structural members in the NERVA reactor, and its structural integrity is extremely important. The integrity of the ring-stiffened Dome End Support Cylinder is analyzed in relation to the maximum loadings anticipated during the NRX A-1 and NRX A-2 tests. From these evaluations it is concluded that the structure can withstand a 110 psi differential radial pressure, which is twice the maximum anticipated loading. (auth)

23803 (WANL-TME-615) STRESS ANALYSIS: NRX-A CONTROL DRUM ASSEMBLY. Ulrich, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1964. 68p. Dep. NTIS $6.50.

Declassified 10 Sep 1973.

A detailed stress analysis of the actuator drive shaft and the components of the control drum assembly has been carried out for full-power, steady state operating conditions. A summary of the results for each component analyzed is presented. The calculations, figures, and descriptions of the various components analyzed are given. In all cases, the latest available mechanical and thermal input data were used, along with conservative assumptions where unknown parametric values arose. The conclusion drawn is that the design of the control drum components and drive shaft is acceptable and that the unit will function adequately during full-power, steady state operation. (auth)

23804 (WANL-TME-655) ANALYSIS AND DESIGN SIGNIFICANCE OF THE B-3, SINGLE SEAL, HIGH PRESSURE, ISOTHERMAL TEST DATA. Rieke, K. L.; Miller, A. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1964. 23p. Dep. NTIS $4.25.

Declassified 12 Sep 1973.

The results of a high pressure, isothermal test on a single seal with no machined seal grooves are reported and indicate that the magnitude of the leakage past the radial seal seat and/or the scarf joint is equivalent to approximately a 0.001 inch gap all around the core periphery. The analysis of the lateral support and seal system has heretofore assumed that this radial seat was completely effective and no leakage occurred. The addition of this 0.001 inch gap results in a negligible change in seal pressure distributions and will, therefore, not significantly affect any of the NRX-A1 test analyses. However, the small increment in seal flow rate which results could affect the seal temperature distributions slightly during powered operation. On the basis of this correlation between the initial test data and analytical results, it appears that the analytical methods used and assumptions made to predict the unheated single seal flow characteristics are reasonable, and may be used with confidence for the NRX-A1 flow conditions. Further tests are recommended to determine the source of the leaks and the effects of deeper seal grooves, filler strip gap size and variations of operating conditions. (auth)

23805 (WANL-TME-710(Rev.A)) RADIATION EFFECTS DATA BOOK. Zorn, J. B.; Rothleder, B. M. (comp.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jan 1965. 394p. Dep. NTIS $22.75.

Declassified 14 Jul 1975.

This document deals primarily with the instruments, mechanical components and materials associated with the NERVA Reactor Subsystem. It contains a summary of all irradiation tests completed by WANL for the NERVA program beginning with the last issue of the Radiation Effects Data Book on September 30, 1963. The WANL effort covered updates the Data Book and provides an assessment of the various component designs and material selections with respect to their capability for withstanding the combined radiation and non-nuclear environment expected in NERVA. It also serves to consolidate under one cover the salient features of all radiation effects tests performed by WANL. (auth)

23806 (WANL-TME-738) INVESTIGATION OF TITANIUM BOLT FAILURES. Filippi, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 11p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Five of the 28 plated titanium bolts which ruptured during the vibration test of reactor build ND 20101 were examined metallographically to gain some insight into the cause and type of failure. Samples from sixteen ruptured bolts were also analyzed for hydrogen content. Microstructural examination revealed a lack of material deformation around the thread contour implying the use of thread machining or grinding rather than thread rolling. It was subsequently discovered that threading was performed by grinding. The structure of the bolt material was characteristic of small diameter 5Al−2.5Sn−titanium bar stock being primarily fine grain (ASTM 7-8) with slight evidence of transformed beta structure, and relatively clean. No evidence of the embrittling, needle-like hydride precipitates was noted in the microstructure and the hydrogen content of sixteen failed bolts was in the range 55 to 97 ppm (well below the specification maximum of 150 ppm and the solubility limit of approximately 300 ppm). All metallographic and analytical evidence show the bolt material to be characteristic of sound 5Al−2.5Sn−titanium. Very high magnification metallography revealed small cracks 0.0001 to 0.0005″ long extending from the plating-titanium interference into the titanium both at the sides and root of the threads, and extending roughly perpendicular to the thread contour. The environmental condition of vibration implies that the failures occurred by fatigue. This conclusion is somewhat supported by the metallographic observations which did not reveal any deformation in the material immediately adjacent to large partially-propagated cracks, and by the transgranular nature of these cracks. The fatigue resistance of the bolts must have been lowered due to the presence of ground rather than rolled threads, and may have been lowered additionally by the presence of surface flaws as well as a titanium electroless-nickel brittle reaction zone. (auth)

23807 (WANL-TME-740) STRESS ANALYSIS: NRX-A UNFUELED ELEMENTS AND MISCELLANEOUS CLUSTER COMPONENTS. Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 36p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

The full-power, steady-state stress analyses of the unfueled element and the various components which comprise the NRX-A fuel cluster support system are presented. The temperature distribution around the support components is shown. From these analyses it is concluded that the maximum anticipated stresses for all of these components is less than the minimum strength. However, in the case of the insulating cup, these values are close enough to the minimum strength to suggest that additional tests should be run to evaluate the reliability of the cup. (auth)

23808 (WANL-TME-751) REVIEW OF NERVA FUEL DEVELOPMENT AND EVALUATION PROGRAM. Boltax, A.; Meuche, C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Apr 1964. 39p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

The NERVA Fuel Element Development and Evaluation Program at the Westinghouse Astronuclear Laboratory encompasses three basic project activities: Fuel Element Fabrication and Related Graphite Parts; Fuel Element Process Development and Control; and Reactor Fuel Materials Development and Evaluation. The programs provide the support for the specification and procurement of the required raw materials; equipment specification, procurement and modification; process definition, development and control; facility operation to produce the required fuel elements, and the in-process quality control and final inspection. The Fuel Materials Department provides the basic fuel development required for improved raw materials and improved

processes and techniques. Extensive evaluations of fuel element capabilities are made to determine corrosion, mechanical, thermal, nuclear, and operational characteristics. Post-operative investigations of fuel elements after NRX reactor tests are included in this project. This report presents the present problems and unknowns, the present and projected technical investigations, development programs and goals, and the staffing and equipment requirements. (auth)

23809 (WANL-TME-752) TEST CELL "A" ADEQUACY REVIEW IN SUPPORT OF THE NRX-A2 TEST. Gahagen, F. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1964. 29p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

This analysis demonstrates that Test Cell A is adequate in all respects for performance of the proposed NRX-A2 reactor tests. Capacities of both gas and liquid coolants are sufficient to support a run profile based on more demanding capacity requirements than the actual test profile. Available test cell storage includes sufficient capacity for the expected normal reactor cooldown and for an increased helium gas usage for an emergency cooldown mode. With the flexibility available at Test Cell A several cooldown plans are possible using different cooling gases during various stages of the cooldown. For purposes of this analysis the most facility demanding cooldown mode was used. The run and cooldown profiles analyzed are not therefore intended to indicate the actual NRX-A2 profiles to be used but rather are presented only to conservatively prove that Test Cell A is adequate to support the NRX-A2 tests. (auth)

23810 (WANL-TME-763) SUMMARY OF NERVA INSTRUMENTATION QUARTERLY DESIGN REVIEW AT AGC. Progress Report, 15–16 April 1964. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1964. 136p. Dep. NTIS $10.00.

Declassified 11 Sep 1973.

The most significant results reported were the efforts to develop protected tungsten-tungsten 26% rhenium thermocouples for the measurement of very high temperatures. Some results with calorimeters, pressure transducers, accelerometers, strain gages and displacement gages were reported, including radiation and radiation heating effects occurring in such instruments. (LTN)

23811 (WANL-TME-765) EVALUATION OF NRX-A2 TYPE INNER REFLECTOR PROPERTIES. Pollack, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 May 1964. 70p. Dep. NTIS $6.50.

Declassified 11 Sep 1973.

An evaluation has been made of H4LM and ATL grades of graphite from which inner reflector cylinders have been fabricated. Extruded H4LM graphite has significantly higher mechanical properties than the molded ATL graphite. The strength of graphite cylinders containing a high number of radiographic indications or discontinuities was found to be lower than the average. This is attributed to the lower strength of the graphite matrix and to the lower load carrying ability of areas containing low-density indications in the matrix. However, no correlation was found between high density radiographic indications and mechanical properties. Differences were noted in the microporosity of the structure of the graphite cylinders which appear to be related to their mechanical strength. A trend also was shown which relates electrical resistivity of the cylinder to its mechanical strength. An effect on electrical resistivity due to chemical impurities was noted for cylinders containing a large number of radiographic indications. The data were insufficient, however, to determine the interdependency of these properties. (auth)

23812 (WANL-TME-766) DESCRIPTION AND HAZARDS ANALYSIS OF THIRD SERIES OF THERMAL STRESS EXPERIMENTS ON LARGE SAMPLES OF NERVA FUEL MATERIAL IN TREAT. Fiore, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 May 1964. 18p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The scope of work planned on NERVA fuel material in a dynamic coolant (helium) environment in TREAT is outlined, the design of the test system is described and possible hazards associated with the experiments are analyzed. The purpose is to calibrate the dynamic coolant flow system while flowing helium through large (6 to 9 inch) NERVA fuel samples located inside autoclaves inserted in the TREAT slot position. After a series of calibrations, thermal stress and material behavior experiments will be performed involving single flat-top transients on each fuel specimen. All tests will contain up to 9 inch of 19 hole, NbC lined, NERVA fuel material containing approximately 21 gm of U-235. The first test will involve flat-top pulsing the same fuel specimen 3-5 times with helium flowing through the center seven channels in order to determine the relationship between fuel temperatures, reactor power level and helium coolant flow rate. Fuel temperatures will be in the range 1500-2500°C. Coolant flow rate and reactor power level will be adjusted on the basis of temperatures measured on the fuel surfaces, in the gas stream and on the graphite crucible during each preceding pulse. The second test will involve helium flow through a seven channel configuration with one or more of the channels mechanically plugged. The third test will be designed to provide convection cooling of one of the six lateral surfaces of the hexagonal shape. Various malfunctions have been described and it has been shown that the most serious credible but not likely event would be rupture of the helium flow system. The result would be contamination of the reactor building. However, the TREAT reactor is located remote from personnel and no hazard would result from building contamination. Any other malfunctions will not result in any unsafe conditions. The safety factors built into the system, and the pre-irradiation tests will minimize the possibility of a system rupture and provide a safe operating environment. (auth)

23813 (WANL-TME-778) NRX-A2 MECHANICAL DESIGN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 229p. Dep. NTIS $14.50.

Declassified 11 Sep 1973.

The NRX-A2 is the first fueled reactor in the NRX-A series. The mechanical configuration is basically the same as the NRX-A1 except for a number of changes resulting from continuing analysis and cold flow tests at NRDS. The NRX-A2 reactor is limited in power, temperature, and operating times to a level below the original design intent. These limits are imposed by the low corrosion resistance of the fueled elements and by a potential interference between the core and the graphite reflector near design conditions. All other components are capable of sustaining the full design output of 1120 MW with 71 lb/sec hydrogen flow and 4090°R chamber temperature. The basic configuration of the NRX-A2 is described in detail in order to present, in one document, a complete description of the NRX-A2 reactor without making continuous references to supplementary documents. (auth)

23814 (WANL-TME-840) REACTOR ANALYSIS DATA FOR NRX-A REACTORS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 31 Jul 1964. 565p. Dep. NTIS $31.25.

Declassified 10 Sep 1973.

Various data on NRX reactors is compiled into one organized document. The Data Book is organized as follows: Introduction, basic design requirements, geometrical and mass data, thermal cycle performance data, nuclear data, radiation and shielding data, reflectors (thermal and hydraulic data), shield (thermal and hydraulic data), reactor core (thermal and hydraulic data), and reference reports. This issue contains data on NRX-A2, -A3 and -A4 reactors. (LTN)

23815 (WANL-TME-846) ANALYSIS AND DESIGN SIGNIFICANCE OF NOZZLE INTERFACE SEAL LEAKAGE TEST RESULTS. Miller, A. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1964. 14p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The interface seal between the inner reflector cylinder and the nozzle flange prevents coolant flow from bypassing the reflector system and core and flowing directly from the reflector inlet plenum to the core exit. Its effectiveness is important to both the performance and structural integrity of the reactor. Analysis of the results of tests on the nozzle interface seal reveals that the seal is effective and that the leakage past the seal has no significant detrimental effect on reactor performance. The leakage rate past the seal is no more than four percent of the lateral support system coolant flow at full power operation. A four percent leakage rate would result in a bulk temperature change in this coolant of less than 50 R. It is therefore concluded that the nozzle interface seal will perform satisfactorily in the NRX-A2 reactor at all power levels up to and including full power. (auth)

23816 (WANL-TME-851) SHAKE TEST OF THE NRX-A1 REACTOR TEST CAR SYSTEM AT NEVADA. Warner, P. C.; Igne, E. G.; Persin, W.; Bove, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 14p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Despite a number of KIWI tests for short times at various power levels, there is available practically no data which permits an estimate of the acoustic pressures and, therefore, oscillating forces on the reactor-test car system. The characteristics of

the NRX-A system are unknown; in fact, the NRX-A system is different from the KIWI system in certain significant respects. For example, the NRX-A reactor sits higher up in the air. For these reasons, it is not clear that there will be no vibration of the engine-test car system involving gross motions of the reactor at levels sufficiently severe to cause mechanical failures or to cause testing to be curtailed. While it is not possible to estimate the forces until experimental data are available from power tests, it is possible to survey the reactor-test car system to determine the first few (and likely most important) modes of motion and particularly their magnification at resonance. A reactor-test car system vibration survey, intended to reveal any resonances in the low frequency range (0 to 50 cps) which have unduly large resonant magnification, was successfully carried out. The first few resonances in each direction were studied and found to have favorably low resonant magnifications. No physical changes to the system are contemplated as a result of these tests. (auth)

23817 (WANL-TME-862) NRX-A1 TEAR DOWN ANALYSIS. Schlitt, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 41p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

During the Cold Flow Test Series, the NRX-A1 reactor met all prescribed tests satisfactorily. The assembly was notably free of vibration, a condition set down as one of the major objectives of the test. From the standpoint of reactor design, the major objective was to evaluate the adequacy of all mechanical and structural parts under the test conditions imposed. The minimum criteria for accepting performance as "adequate" was that no failure of parts should cause the test to be shut down. It was hoped, however, that unknown problem areas such as vibration, overstress, sticking, rubbing, and similar conditions would show up noncatastrophically in the assembly such as to allow correction prior to power tests. Therefore, it was most important that the test article be examined after the test and malfunctions traced so that improvements could be made in the design of later reactors. The two major assemblies of the NRX-A1 reactor are the outer reflector and the core-inner reflector combination. The outer reflector furnishes the structural support for the overall assembly and also houses the reactor control surfaces. Insofar as the test was concerned, the outer reflector performed adequately. However, although no parts were broken to the extent that a test shutdown was necessary, a number of major problems were encountered, together with some relatively minor problems. The major problems were control drum rubbing, cracking of the nozzle end spigot in the sectors, and cracking of the thin web section in the sectors. Minor problems uncovered were debris blocking flow holes, oil, minor movements and vibration, broken small parts, scratches in the bore and on the O. D. of the sectors, and markings on bearings. The core-inner reflector assembly also met all the test requirements. No major problems were encountered, but a number of minor problems were noted. Among these problems were loose tie rods in the core, steps between support blocks and between filler strips, broken hardware, minor marking of the aluminum barrel and minor indications on the seal segments and filler strips. All of these problems are discussed in detail. (auth)

23818 (WANL-TME-867) NOZZLE INTERFACE SEAL TEST: MECHANICAL LOADING AND SEAL LEAKAGE. Final Report, EML-26. Parker, W. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 33p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

During operation of the nuclear reactor engine, the nozzle interface seal is subjected to axial compressive loads and lateral gaseous pressures. Excessive gas leakage past the nozzle seal could result in a compromise of reactor performance. Therefore, a series of tests to aid in the evaluation of the operational integrity of the nozzle seal were performed. Test data is presented describing the leakage rate across the interface seal and inner reflector/nozzle flange seal (excluding the effects of the inner reflector pressure relief channels) for nitrogen and hydrogen gas environments. Test data is also presented describing the deformation and strain characteristics of the seal subjected to axially applied compressive loads. Results from these tests indicate that the design of the interface seal is satisfactory for withstanding axial loads resulting from mechanical compression of the seal. The leakage rate excluding the effects of the inner reflector pressure relief channels was small in comparison to the permeability of the inner reflector (approximately 20 percent). (auth)

23819 (WANL-TME-870) REACTOR NON-FUEL MATERIALS PROGRAM, 1964–1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Aug 1964. 61p. Dep. NTIS $6.25.

Declassified 11 Sep 1973.

The reactor non-fuel materials program involved vendor liaison (including evaluation and consultation), materials evaluation (including application and behavior), fabrication development, radiation effects and specifications preparation in support of design effort, hardware procurement and reactor assembly. Materials and processes receiving special attention were: pyrolytic graphite, structural graphite, beryllium, titanium alloys, adhesives, aluminum alloys, forging, and welding. The effects of irradiation were measured on several alloys used in NERVA. Approximately 50 new specifications were developed and 70 were revised. Some of these required considerable effort, e.g. those related to fuel. Planned research programs are developed in some detail. Many details are given. (LTN)

23820 (WANL-TME-887(Suppl. 1)) ALTERNATIVE NRX-A2 SHUTDOWN USING THE PRESSURE CONTROL LOOP AROUND PCV-41. Knecht, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Aug 1964. 9p. Dep. NTIS $4.00.

Declassified 14 Jul 1975.

A shutdown which utilizes the pressure control loop around PCV-41 is under consideration for the NRX-A2 test. This shutdown is an alternative to the one in the NRX-A2 prediction report. The primary difference between the two shutdown schemes is the method used to supply and initiate ambient hydrogen to the reactor following scram. For the alternative shutdown ambient hydrogen is supplied through PCV-41 instead of PCV-123, and the change from liquid to ambient hydrogen is accomplished by an automatic system. The following procedure defines this alternative shutdown: (1) The chamber temperature is ramped from the operating condition to 2200°R by reversing the direction of rotation of the test profile control drums. (2) At 2200°R chamber temperature the automatic flow shutdown procedure is initiated. This procedure automatically scrams the reactor, discontinues pump operation, and opens PCV-41 to maintain the mixing chamber exit pressure at 50% of the pressure before initiation of shutdown. (3) The resulting flow is continued until the chamber temperature has decreased to 1200°R. From this time on further cooling is similar to the cooldown specified in Reference 1. It is concluded that (1) This alternative shutdown satisfies all reactor limitations such as 90°R minimum core inlet temperature, 1200°R maximum tie rod exit temperature, and 2 dollars minimum shutdown reactivity. (2) The alternative shutdown using the pressure control loop around PCV-41 should produce a smoother transition from liquid to ambient hydrogen feed. (auth)

23821 (WANL-TME-888) POST OPERATIVE STRUCTURAL ANALYSIS OF NRX-A1. Buzza, C. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1964. 19p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

In general the NRX-A1 reactor components performed as expected both structurally and mechanically during the NRX-A1 Cold Flow Tests. The few problem areas that did come to light include control drum binding, outer reflector-pressure vessel interference, reflector sector cracks and tie rod vibration. These areas have been extensively investigated and analyzed and the results are reported. Modifications have been incorporated into the NRX-A2 and subsequent reactors to eliminate these problem areas. (auth)

23822 (WANL-TME-895) REQUIREMENTS FOR CAPSULE DISASSEMBLY AND POST-IRRADIATION ANALYSIS. Fuel Irradiation Program, Series T-T. Phase II. Jacobs, D.; Glassmire, C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 11p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Specifications are provided (1) for the disassembly of irradiation capsules which have been irradiated in the GETR reactor and (2) for the examinations of the irradiated fuel pellets they contain. The following are required: Flux wire analysis, measurement of dimensions, photographs, metallography, compressive strength measurements, hardness on specified numbers of samples. (LTN)

23823 (WANL-TME-936) DEVELOPMENT OF A METHOD FOR COMPUTING THE COLD-TO-HOT REACTIVITY CHANGE IN THE NRX-A ASSEMBLIES. Mowery, A. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1964. 68p. Dep. NTIS $6.50.

Declassified 11 Sep 1973.

A method for computing the cold-to-hot reactivity change was developed for NRX-A2; the method can probably be extended to subsequent NRX assemblies. This method was based on the determination of reactivity coefficients of the major propellant and temperature effects. An IBM 7094 computer code, COHOT,

was written to facilitate the calculation of the reactivity change. The estimated two standard deviation uncertainty is $0.30 for the cold-to-hot reactivity change. This includes an estimate of the TNT uncertainty. These uncertainties are difficult to evaluate due to the almost complete lack of experimental verification. The one check with the recent KIWI-B4D hot test did agree to within the estimated error. However, the experimental results were obscured by the large reactivity (~$1.5) loss from release of adsorbed hydrogen and the inaccuracies in the experimental determination of the actual power level and propellant flow rate. The lack of confirmation of the effects of hydrogen and temperature on the core and reflector at operating conditions can be alleviated only through a thorough experimental investigation. This can be accomplished in a future NRX-A hot test Combinations of holds that are "power rich" leading to net negative reactivity changes and holds that are "flow rich" leading to net positive reactivity changes could be employed to verify the cold-to-hot reactivity change calculations. This would lead to increased confidence in the predictions and concomitant reductions in the uncertainty for future hot test analyses. A simplified formulation of the cold-to-hot reactivity change is presented. The formulation depends on four parameters: average core hydrogen density, average core temperature, average lateral support hydrogen density, and average beryllium temperature. This agrees with the detailed equation to ~$0.15 in steady-state cases; the accuracy is reduced in transient problems. The formula is used in TNT for preliminary estimates of reactivity effects. (auth)

23824 (WANL-TME-980) PARTIAL LENGTH CORE ASSEMBLY VIBRATION TEST IMPREGNATED INNER REFLECTOR EML-6. Gyurek, J. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 10p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Dynamic testing is desirable to determine the response of the specimen to known inputs and to determine the resulting component wear. This test was conducted on a partial length core specimen of components of the latest NRX-A2 design with an impregnated inner reflector for comparison with previous testing of a specimen with an unimpregnated inner reflector (B-5 Test). The specimen consisted of a ten inch long section of inner reflector (impregnated), three rows of the lateral support system and a nine inch long core of individual elements. In both tests the specimen was installed in a support fixture, placed on four oil film slip tables and excited by a electrodynamic thruster. The input and specimen response were monitored by transducers. The data from these tests revealed that the "G" levels that produce core breakaway (initiation of core to inner reflector relative motion), lockup (termination of relative motion) and impact on the inner reflector were lower for this test than those of the B-5 Test. Both tests, however, reveal that breakaway and lockup "G" levels decrease with increasing frequency. During both this test and the B-5 test, considerable abrasion of the plungers and gouging of the seals occurred at their point of contact. Wear in other areas was insignificant. The wear occurring during this test resulted from higher "G" levels and a greater number of cycles than the actual reactor is expected to experience. Separation of elements was detected at the higher "G" levels (about 4 "G"). There was no breakage of components even after core impacting on the inner reflector. (auth)

23825 (WANL-TME-1003) COMPARISON OF KIWI B-4D EXPERIMENTAL RESULTS WITH TNT CODE CALCULATIONS. Pierce, B. L.; Zemanick, P. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Oct 1964. 18p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The KIWI B-4D-202 reactor tests, being the first stable tests of a NERVA-type reactor at significant power levels, were considered a good opportunity to check the adequacy of the TNT computer code. This was considered important since this code has been used extensively in thermal and hydraulic analysis of the NRX-A reactors. The comparison between the TNT calculated parameters and the KIWI test data was found to be very good. (auth)

23826 (WANL-TME-1005) STRESS ANALYSIS: OUTER REFLECTOR SUPPORT RINGS. Pianka, E. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1964. 25p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

Stress calculations on the dome end support ring plate are updated using newly acquired data on pressure drops and temperatures. In addition, the stresses in the nozzle end support ring are analyzed. This analysis and the pertinent component tests show that the dome and nozzle end support rings are satisfactory for their intended service. (auth)

23827 (WANL-TME-1008) TEST REPORT ON PIEZOELECTRIC CRYSTAL DISCS EXPERIMENT NO. 23/W003 IRRADIATED AT THE GROUND TEST REACTOR (GRT TEST 13). Grimm, D. E.; Loftus, W. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1964. 19p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Irradiation Test 23/W003 was conducted in the three megawatt Ground Test Reactor as a screening test to determine the relative radiation resistance of several piezoelectric materials used in this type accelerometer. The main advantages of the piezoelectric accelerometer are small physical size and high frequency response. Several important conclusions are summarized: The crystals saw an environment similar to that which would be seen by the crystal of an accelerometer in an NRX pressure vessel; piezoelectric crystals tend to be depolarized and rendered useless by radiation; some recovery of activity does occur for a time after irradiation which is a shortcoming with respect to the proposed application since it would confuse post-irradiation calibrations; and none of the crystal types tested could be made into an accelerometer that would be recommended for use inside an NRX pressure vessel. Details of the test and the methods used in interpreting the results are given. (auth)

23828 (WANL-TME-1011) STRESS ANALYSIS: NRX-A FORWARD FUEL CLUSTER SUPPORT COMPONENTS AND FLOW SCREEN. Campbell, C. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1964. 41p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

The components of the forward end fuel cluster support and the flow screen were analyzed in accordance with the "NRX-A Stress Criteria". Since the resulting Margin of Safety of each item was greater than zero, all components are considered adequate for their intended use. (auth)

23829 (WANL-TME-1013) NERVA, A TWO DIMENSIONAL EXCURSION ANALYSIS PROGRAM. Call, D. W.; Roidt, M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Oct 1964. 39p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

A computer program is described which calculates the energy release from a large nuclear excursion using a two dimensional model. Estimates of power-time profiles during excursions of the NERVA reactor are determined for various prompt step reactivity additions to the room temperature core. A hydrodynamic, radially symmetric excursion model has been assumed. The energy release is conservative (overestimated) due to assumptions related to the boundary conditions and isotropy of the core. (auth)

23830 (WANL-TME-1016) WESTINGHOUSE ASTRONUCLEAR LABORATORY CONTRIBUTION TO THE NINETEENTH HIGH TEMPERATURE FUEL COMMITTEE MEETING, 16–18 NOVEMBER 1964. Tobin, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Oct 1964. 24p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

Advances in the high temperature fuel element materials program for the development of the NERVA nuclear rocket engine are described. The principal topics include: a review of current reactor tests, NERVA fuel element development, high temperature studies of fuel materials, and results from irradiation test experiments. (auth)

23831 (WANL-TME-1050) NRX-A3 TEST PREDICTION REPORT. Howarth, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1965. 136p. Dep. NTIS $10.00.

Declassified 11 Sep 1973.

A series of tests will be performed on the NRX-A3 reactor at the Nuclear Rocket Development Station in Nevada to provide significant development information on the test article assembly. "Quick Look" predictions for these tests are contained herein. These data can be compared with test data displayed on Sanborn records so that it is possible to judge during or after the test whether or not the reactor has operated in a normal manner. In addition to predictions for normal reactor operation, predictions are given for power scram, pump failure, fire and nozzle flow loss emergencies. (auth)

23832 (WANL-TME-1077) SECTOR SPIGOT COMPRESSIVE LOAD TEST (AT CRYOGENIC TEMPERATURE). Kallin, I. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1965. 11p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Hoop-type compression loading in the reflector nozzle end support ring is believed to have occurred in the NRX-A1 reactor

tests due to transient differential thermal contractions between the support ring and the pressure vessel. After the tests, all the sector spigots were found to be broken. The upper bound diametral spigot contraction and maximum compressive load on the spigot were computed to be about 0.0060 in. and 6,000 lb, respectively. The objective of this test was to apply the same type of loading to a sector at the cryogenic temperature condition and determine whether the same mode of fracture would occur within the deflection limit imposed in the reactor. The load was applied in increments of 50 and 100 lb and the diametral spigot contraction measured at each load increment. As a load of 4500 lb was being applied to the plate, a loud noise was heard and the deflection transducer jumped from a diametral contraction of 0.0021 to 0.0083 in. The indicated load dropped from 4500 to 3450 lb. Disassembly revealed a large crack in the base of the spigot, running about 130° around the spigot under the direction of loading. This crack is similar to crack modes found after the NRX-A1 tests. Since a similar mode of fracture was produced within the limits of deflection and load calculated to have occurred in the NRX-A1 sectors, the type of loading applied can be assumed to be the same as that which occurred in the full reactor tests; and the cause of failure proposed for the NRX-A1 spigot fractures, i.e., pressure vessel interference with the reflector, is indeed the right one. (auth)

23833 (WANL-TME-1079) NRX-A2 INSTRUMENTATION DISASSEMBLY AND POST OPERATIVE REPORT. Chambers, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Jan 1965. 47p. Dep. NTIS $5.50.

Declassified 11 Sep 1973.

After the NRX-A2 reactor test was completed, the reactor instrumentation was disassembled by remote handling methods and examined. Only the tie rod exit gas and seal chamber thermocouples did not perform as expected: Installation problems, potting cement failure and, in some cases, failure of the tantalum sheath of the thermocouples were problems which could be identified. Except for a few other described problems, the instrumentation appeared to be in good condition. Some difficulties in the remote disassembly are discussed. (LTN)

23834 (WANL-TME-1099) STRESS ANALYSIS: NRX-A3. Eggers, A. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1965. 30p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

The analyses performed to determine if the NRX-A3 is structurally capable of withstanding the conditions which will be imposed on it during the forthcoming test are summarized. Since the NRX-A3 differs only slightly from the NRX-A2, the run profiles are very similar and the NRX-A2 survived its testing without serious damage, it is concluded that there is no condition sufficiently severe to prevent the test from being successful. With worst tolerances, slight control drum rubbing could occur in the full out position. Since the drums are not expected to move out beyond 110°, there should be no rubbing. However, if the startup should be at 150°R/sec, the most conservative method of analysis shows that some drums could jam for 5 seconds. (auth)

23835 (WANL-TME-1104) NOTES OF MONTHLY COMPONENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON FEBRUARY 4, 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1965. 13p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Tests were concerned with testing fuel elements and fuel element clusters, mainly with respect to corrosion. Several tests of other reactor components are discussed briefly. (LTN)

23836 (WANL-TME-1119) DEFINITION OF NRX-A3 TEST PARAMETER LIMITS. Buthmann, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Mar 1965. 12p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The Test Parameter Limits for the NRX-A3 Test are justified, explained and defined. The information will be of aid to the engineering groups in the planning, testing, and conduction of the NRX-A3 tests Because of the brief rate of rise and the thermal time constants of the material, the maximum excursions permissible within these limits are not sufficient to cause thermal transients rapid enough to cause damage to any of the reactor components. (auth)

23837 (WANL-TME-1122) POST-OPERATIONAL EVALUATION OF NRX-A2 REACTOR FUEL ELEMENTS. Simmons, C. R.; Jacobs, D. C.; Vogel, M. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1965. 113p. Dep. NTIS $8.75.

Declassified 14 Jul 1975.

From an overall point of view, the NRX-A2 reactor test produced only light surface and channel corrosion in the fuel elements. However, heavy surface corrosion resulted on 200 fuel elements as a result of hydrogen leakage from pyrotile joints and from thermocouple installations. The presence of a partially surface (NbC) coated element in the A2 core demonstrated that this was effective in reducing tile associated corrosion. It is believed that design, material, and operational changes ("fixes") incorporated in NRX-A3 will significantly reduce corrosion from peripheral leakage and thermocouple installations. Corrosion occurred at the coated end of all but 13 fuel elements in the core. End corrosion typically produced taper and NbC exposure at the hot end and a characteristic corrosion band at the shoulder of the undercut area. The least amount of end corrosion occurred on elements which had been recoated at Oak Ridge, Y-12. The addition of an unfueled wafer tip to the coated end of NRX-A3 fuel elements should significantly reduce the type of end corrosion observed in NRX-A2 elements. Visual examination established that 58 fuel elements had $1/64$ to $1/16$ inch diameter pinholes on the surface. Axial sectioning and metallographic examination revealed the presence of corrosion pockets under the NbC coating as well as general light attack of the graphite binder. Weight loss analysis of A2 fuel elements indicated an average weight loss of 1.0 ± 0.3 grams for elements with no heavy surface corrosion and with typical bore and end corrosion. The weight loss in peripheral elements with heavy tile pattern corrosion and elements with heavy thermocouple associated corrosion averaged 4.5 grams. Two significant observations were brought to light by the analysis of the differences between electrical hydrogen corrosion testing and reactor corrosion of fuel elements. One observation suggests that the corrosion rate of fueled graphite may be 2–3 times faster in reactor than determined from the electrical corrosion tests. The second observation relates to the role of graphite matrix porosity on pinhole formation. It is suggested that further consideration be given to methods for reducing fuel element porosity as one means of minimizing the frequency of pinhole formation. (auth)

23838 (WANL-TME-1147) REACTIVITY EFFECTS OF THE PROPOSED SNPO-C COUNTERMEASURE EXPLOSIVE PROJECTILE DESTRUCT SYSTEM. Sipush, P. J.; Ravets, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1965. 34p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

An evaluation is presented of the reactivity changes in the NRX-A reactor by the insertion of four titanium-cased explosive projectiles. The projectiles are for use as an in-flight destruct system. The basic tool utilized in the calculations of reactivity changes was the (r,θ) CURE diffusion theory code. In addition, the effect of radiation heating on the projectile system before insertion into the core was estimated. It was found that all the projectiles considered (90, 105 and 120 mm) are feasible, since they introduce less reactivity than the maximum shutdown available (4.35$). The 120 mm projectile is outstanding, however, because it introduces much less reactivity than the other projectiles. This is due mainly to the thicker (0.375 inch) titanium casing. The worth of four 120 mm projectiles was calculated to be about +1.03$ using the actual material number densities. If, as a conservatism, the carbon and hydrogen concentration in the explosive is corrected by the experimental-to-calculated reactivity coefficient ratio (approximately 11/7), the resulting worth of the projectiles in increased to about 1.50$. In comparison, the corrected worth of four 105 mm shells having 0.25 inch casings is approximately 4.05$, which is only 30¢ lower than the shutdown margin. It is therefore recommended that either the as-designed 120 mm projectile be used, or a smaller projectile with a heavier casing (greater than 0.25 inch). As an alternate, if practicable from a radiation heating standpoint, thermal absorber material could be placed in the projectile to reduce the reactivity insertion. The radiation heating rates in the destruct system were estimated for full power (1120 MW thermal) operation. The results and calculational procedure are given. This analysis was performed for first look values. (auth)

23839 (WANL-TME-1149) WESTINGHOUSE ASTRONUCLEAR LABORATORY CONTRIBUTION TO THE TWENTIETH HIGH TEMPERATURE FUEL COMMITTEE MEETING, 18–20 May 1965. Boltax, A.; Tobin, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 May 1965. 43p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

The post-operational examinations of the NRX-A2 fuel elements at R-MAD included gross visual examination, weighing and whole body ionization measurements of all (1626) of the fuel elements in the core. The post-operational studies at LASL included metallographic examinations and flexure strength tests on selected fuel samples from the NRX-A2 core. From an overall point of view, the NRX-A2 reactor test produced only light surface and channel corrosion in the fuel elements. Heavy surface

corrosion resulted on 200 fuel elements as a result of hydrogen leakage inwards from the reactor periphery. A summary of hydrogen corrosion data obtained in the electrical test facility on NRX-A2, A3, and A4 fuel elements produced at the Westinghouse Astrofuel Facility (WAFF) and at the Y-12 plant at Oak Ridge is presented. The overlap of the data for the various test conditions represents element to element variability and test temperature variability and uncertainty. The corrosion test data has been analyzed in terms of three principal mechanisms of carbon weight loss. The corrosion mechanisms include: corrosion at cracks in the NbC coating; corrosion in defects in the NbC coating (other than cracks); and carbon diffusion through the NbC coating. The results of this analysis are reviewed briefly. A major improvement in the bonding of graphite fuel element parts has been found in the development of the liquid-phase zirconium (LPZ) brazing process. The coating of graphite fuel element surfaces with ZrC by the LPZ process has also been developed and shows promise for a hydrogen corrosion protective coating on graphite. Decarburization experiments with NbC in hydrogen have indicated an advantage in hot hydrogen corrosion protection of graphite may be obtained by the intentional addition of a fraction of a per cent of methane to the hydrogen. Carbon diffusion experiments in TaC indicate that a coating of TaC may be superior to NbC as a carbon diffusion barrier at high temperatures (above 2000°C). (auth)

23840 (WANL-TME-1155) NOTES OF MONTHLY COMPONENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON APRIL 9, 1965. McCreary, H. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1965. 10p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Tests in support of NRX-A2 and NRX-A4 involved development and testing of fuel elements and fuel element clusters, including tests of hydrogen corrosion at high temperatures and of the thermal behavior of the clusters. Other tests involved supports, reflectors, seals, wrappers, etc. More complex experimental tests were made to measure the core effective gap (including the effects of coatings) and the effects of plugged channels using methane as a tracer in the hydrogen. Preliminary results are presented but much of the work to date has been carried out to optimize tracer injection and sampling methods. (LTN)

23841 (WANL-TME-1158) NRX-A3 RESTART REVIEW PRESENTATION 10 AND 11 MAY 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1965. 35p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

Various NRX-A3 reactor data presented at a restart review meeting after EP IV have been documented. The data are concerned mainly with the times at the given high temperatures experienced in the previous testing. No conclusions are given. (LTN)

23842 (WANL-TME-1162) HIGH TEMPERATURE TESTING OF NRX-A2 FUEL ELEMENTS. Kirschner, R. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1965. 85p. Dep. NTIS $7.25.

Declassified 11 Sep 1973.

All quality control and other tests made on NRX-A2 fuel elements are discussed. Such tests as partial clusters, support blocks (both full blocks and partial blocks (lobes)), developmental testing (i.e., corrosion rates, temperature profiles, extended lifetime tests, etc.), and quality control evaluation tests are presented. The handling of fuel elements, designated for quality control testing, is discussed completely, starting with the receipt of the elements from Materials, the pre-test measurements, the transferring of the element to the test rig, the actual testing, and the post-test measurements. The element weight losses and other apposite test data are recapitulated with the corresponding element number and Fluid Flow Laboratory test number. Increased competence has been obtained in the testing of NRX-A2 fuel elements, as evidenced by the increasingly consistent results of element temperature profiles, weight losses, and general overall test repeatability. (auth)

23843 (WANL-TME-1171) EVALUATION OF EXTERNALLY COATED NRX-A3 FUEL ELEMENTS. Leasure, R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1965. 25p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

The coating of the surfaces of the peripheral elements for the NRX-A3 reactor with NbC should significantly improve the hydrogen corrosion behavior of these elements by reducing the corrosion of the element surfaces. Through metallography of elements representative of each surface coating batch, it was observed that the recoat operation had some effect on the original bore coatings. On most surface coating batches grain boundary attack, or etching, was observed between 50 and 52 inches. It was also observed that on most batches a second coat, or undercoating, was deposited between the original bore coat and the matrix. Although the recoat operation had some effect on the bore coatings, hydrogen corrosion tests of the surface coated elements have shown acceptable behavior. The only abnormal corrosion behavior experiences was a slight tendency for some elements to form pinholes. (auth)

23844 (WANL-TME-1178) FUEL ELEMENT HOLE LOCATION SURVEY. Fatzer, E. G.; Sturtevant, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jun 1965. 26p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

The fuel element coolant hole location survey reported covers three types of hole parameters. The first type of parameter considered is the variation in hole location with length of finished (coated) elements manufactured for NRX-A2 and NRX-A3. In this part of the survey, hole location in each of three wafers, taken at designated intervals measured from the serial numbered end, is referred to the corresponding hole location in a fourth wafer taken from the hot end. The second area of investigation was hole mismatch across the cemented joint of the unfueled tip for in-process elements manufactured for NRX-A4. The extent of this mismatch was determined from measurements taken immediately adjacent to and on both sides of the cemented joint. The elements examined were in-process elements checked prior to the application of the niobium carbide coating. The last part of the survey consisted of the determination of variation in location of the outer holes. As in the first series of tests, these were coated elements manufactured for NRX-A2 and NRX-A3. The survey consisted of a total of 2,856 hole location measurements. Samples were taken from 38 elements; 29 of these from NRX-A2 and NRX-A3 production runs and nine from the NRX-A4 production runs. The NRX-A2 and NRX-A3 samples were taken from coated elements previously selected as the one percent destructively-tested core candidate elements per PDS 30021. The NRX-A4 samples were uncoated elements checked for mismatch across the non-fueled tip. (auth)

23845 (WANL-TME-1178(Suppl. 1)) PEWEE 1. Fuel Element Hole Location Survey. Nelson, P. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Apr 1968. 15p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

A hole location survey was conducted to establish the alignment across the two joints in the Pewee 1 composite tip with respect to the hole body pattern of the fuel element. Phase IV-B Fuel Elements were processed for Pewee 1 pre-production qualification, using Pewee 1 production tips and all Pewee 1 processes. The alignment between the hole pattern of the composite tip and the body of the fuel element meets the requirements for the fuel element. (auth)

23846 (WANL-TME-1216) REACTOR NON-FUEL MATERIALS PROGRAM FOR C. Y. 1966. Layland, E. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Jul 1965. 16p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The NERVA non-fuel materials program involves support for other groups as follows: Specifications preparation, drawing reviews, evaluation of variation requests and engineering change orders, vendor liaison (re quality control), consulting on materials problems, trouble shooting, etc. Further, the evaluation and tabulation of the mechanical and physical properties of advanced materials, including changes with temperature, is an increasingly important factor in making possible continued advances both in reactor performance and in maintaining instrumentation capability in extreme temperature and radiation environments. Finally, materials development will be necessary in some areas, such as graphite and its protection from corrosion by hydrogen, materials to withstand irradiation at cryogenic conditions, graphite joining and thermocouples for very high temperature measurement. (LTN)

23847 (WANL-TME-1235) NRX-A4 ELEMENT PLACEMENT AND ORIFICING SUMMARY REPORT. Cort, G. E.; Agosti, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 76p. Dep. NTIS $7.00.

Declassified 14 Jul 1975.

Pertinent core data for the NRX-A4 (ND 10401) reactor is presented in tabular form. The physical location of elements, nuclear shimming, instrumentation, number and sizes of orifices, corrosion batch information, and a summary of the thermal characteristics of each element are included. (auth)

23848 (WANL-TME-1238) RADIATION ANALYSIS OF THE NRX-A4/EST SHIELD CONFIGURATION. Capo, M. A.; Nassano,

R.; Romesburg, H. C.; Stephenson, L. D.; Woodsum, H. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 235p. Dep. NTIS $14.75.

Declassified 12 Sep 1973.

Results of the nuclear analysis of the NRX-A4/EST shield configuration are presented. Activity levels on the test pad 90 days following a full power NRX-A4 run of 35 minutes are given. Predicted gamma ray and fast neutron radiation environment in the test cell during operation are included. Results of a two-dimensional analysis of radiation heating in the privy roof mounted shield and stand are described. Results of an experimental program carried out at WANEF on the NRX-A3 privy roof mounted shield are set forth, and where possible, comparisons between measured and predicted data are included. Analytical methods employed in the NRX-A4/EST shield analysis are also detailed. (auth)

23849 (WANL-TME-1248) SINGLE CLUSTER CORROSION TESTS WANL HYDROGEN CORROSION TEST RUNS 24 NOVEMBER 1964–12 AUGUST 1965. Foster, R. D.; Gilchrist, M. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Aug 1965. 44p. Dep. NTIS $5.25.

Declassified 12 Sep 1973.

The results of the six hydrogen corrosion tests performed on fuel clusters at WANL to date are presented. The tests performed thus far indicate that the progress of the cluster corrosion test system has advanced to the point where clusters can be tested at temperatures very near the desired level. Further effort is required on the type or method of electrical insulation for the center element to extend the temperature capabilities. (auth)

23850 (WANL-TME-1255) PAX EXPERIMENTS IN SUPPORT OF NERVA. Quarterly Report, 4th CY 65. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 137p. Dep. NTIS $10.00.

Declassified 12 Sep 1973.

The PAXC critical experiments included measurements on initial criticality, negative shim worths, flexible poison wires, dosimetry and fission flux determinations for the privy roof mounted shield, and cluster plate characteristics. (auth)

23851 (WANL-TME-1269) EVALUATION OF THE FUEL ELEMENT BETA BACKSCATTER NONDESTRUCTIVE TEST SYSTEM. Cowfer, C. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Oct 1965. 45p. Dep NTIS $5.25.

Declassified 11 Sep 1973.

The beta backscatter nondestructive test system recently installed at the Westinghouse Astrofuel Facility (WAFF), Cheswick, Pennsylvania has been evaluated. The purpose of this test system is to determine the coating thickness of niobium carbide-coated NERVA fuel elements. This evaluation was extremely useful in developing operating and control procedures which achieved a high degree of consistency in the testing of NERVA fuel elements. A statistical analysis of beta backscatter taken as part of this evaluation indicates excellent precision capability for the equipment. Correlation of beta backscatter data with the results of metallographic examinations has established a high degree of confidence in the results provided by this test system. The way in which the niobium carbide protective coating conforms to the applicable drawings and specifications is a determining factor in the acceptance or rejection of fuel elements. This test system is used both as a process control check and as an acceptance test for the coated element. Another important application for the beta backscatter data is to correct the fuel element as-coated uranium loading for the attenuation of the 185 keV uranium gamma rays by the niobium content of the coating. The major backscatter problems are those associated with maintaining system calibration to assure consistent data at all times and to maintain a high level of precision and reliability of the system. Also of importance is the need to optimize the form of the expression for the reduction of the output of the equipment to niobium carbide coating thickness. (auth)

23852 (WANL-TME-1275) COMPARISON OF CARBIDE COATINGS FOR GRAPHITE BASED FUEL ELEMENTS. Cadoff, L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 16p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

It is well established that carbide coatings can protect graphite bodies at elevated temperatures from the corrosive effect of hydrogen. The effectiveness of various integral carbide coating materials in protecting graphite-based, fueled matrices from hydrogen attack is (for a constant coating thickness) a function of two inter-related properties: the carbide carbon activity which is a measure of the reactivity of the carbide with hydrogen and the carbon diffusivity in the carbides which effects the steady-state rate of carbon loss from the matrix. The discussion is limited to comparing the mono-carbides of zirconium, niobium, and tantalum, as they are considered to be the most desirable materials for high temperature nuclear reactor applications. (auth)

23853 (WANL-TME-1276) EVALUATION OF PROTOTYPE FUEL ELEMENT HANDLING CONTAINER. Aducci, S.; Pilgrim, L. G.; Polinak, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 29p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

Damage to fuel elements during "in-process handling" continues to be a significant problem. A substantial number of elements were rejected for use in the NRX-A4, because of in-process damage, with resultant loss in dollars and schedule time. This has been the case for all NRX reactors. Damage to coating, chipping of corners and chipping around flow holes have been the primary causes for rejection. Reactor tests have shown that the operating life of a reactor is adversely affected by imperfections in the niobium carbide coating on the fuel elements. The fuel elements will require a higher quality coating and thus a greater degree of protection to preserve this quality for future longer-life reactors. Improvement in handling technique is imperative for effective resolution of this problem. In order to affect some improvement, a Fuel Element Handling Container was designed and several prototypes fabricated for tests and evaluation. This handling container is proposed as a replacement for the existing fuel element shipping container "suitcase" for use with the existing outer container "birdcage" during transportation and as a handling and storage tray for use during processing and assembly operations. The prototype container was subjected to several tests including a shipping test, impact test and in-process handling test. The results of these tests and subsequent complete evaluation of the prototype container indicate that coating damage and chipping of elements can be substantially reduced with significant savings in time and costs. (auth)

23854 (WANL-TME-1282) DEVELOPMENTAL TEST PROGRAM PRESENTATION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 122p. Dep. NTIS $9.25.

Declassified 11 Sep 1973.

The presentation was devoted mainly to fuel elements (corrosion testing, etc.), supports, tie rods, and control drum bowing problems. (LTN)

23855 (WANL-TME-1286) TEST SERIES FFL-6. Orifice to Element Sealing Development. Edmiston, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 27p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

A seal is required between a multiple hole graphite element and the stainless steel orifice inserted therein. The objective is to develop a satisfactory seal that would have increased temperature capabilities in a radiation environment over that of the present Silastic RTV-891. Two gasket configurations were flow-tested under a pressure differential at ambient temperature and compared for sealing effectiveness against the present material. A common gasket assembly for the entire element face and individual gaskets for each orifice were 12 and 66 percent as effective as the Silastic seal. Neither gasket configuration provided any distinct advantage over the present method. (auth)

23856 (WANL-TME-1288) TEST SERIES HHT-16. Cavity Corrosion Test. Burghardt, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 21p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

A hot periphery core, in which a substantial portion of the temperature drop between the core and reflector would occur within the lateral support system, has been proposed as a solution to the problem of interstitial corrosion. The cavities in the lateral support system would thus operate with one wall at high temperature and one at low temperature. Limited corrosion in these cavities would build up a methane concentration which would inhibit corrosion within the core itself. A series of tests was performed to study corrosion and deposition in an annular cavity simulating the core periphery, at surface temperatures of 3000°R and 4000°R and hydrogen pressures to 600 psia. It was determined that for a cavity sufficiently isolated from a source of fresh hydrogen, minimal corrosion would occur within the cavity, with a build-up of methane definitely indicated under certain conditions by the deposition of pyrolytic graphite. (auth)

23857 (WANL-TME-1290(Vol.2)) NRX-A6 DESIGN REPORT. Thermal, Fluid Flow and Nuclear Analysis of the NRX-A6 Reactor. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1965. 146p. Dep. NTIS $10.50.

Declassified 11 Sep 1973.

The results of the additional thermal, fluid flow, and nuclear analyses performed since the 29 June 1965 review meeting to support the NRX-A6 design effort are presented to permit hardware definition and indicate areas requiring more detailed analyses and/or development testing. The salient results are: The lateral support seal system can function satisfactorily with any of the three designs being considered. Use of the Minimum Leakage Methane Generating Periphery indicates an advantage in terms of the corrosion damage anticipated for the peripheral fuel element. However, attainment of this improvement is dependent upon the demonstration of low peripheral leakage being maintained over the operating life of the reactor. The initial reflector flow balance and steady state full power temperature distributions indicate that in the mid-core region (peak heat flux region), the average reflector temperature is about 410°R with peak temperatures (less than 600°R) occurring in the region 1.5-2.0 inches from the inside diameter. The core reactivity available with present uranium fuel densities is sufficient to meet the anticipated test requirements with over a 3$ reactivity margin. The required reactivity worth of the control drums is 7.0$ and is within the capability of the control drum configuration. The core weight loss due to fuel element bore corrosion for a 60 minute full power run will be approximately 32 kg. This combined with surface corrosion weight loss, is estimated to result in an outward drum rotation of approximately 40 degrees. Concurrent analysis of the reactor configuration at higher power density and flow rate indicates feasibility with no additional major problem area precluding success. (auth)

23858 (WANL-TME-1291) SUMMARY FABRICATION REPORT FOR NRX A-3 FUEL ELEMENTS. Westinghouse Electric Corporation Astrofuel Facility. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1965. 51p. Dep. NTIS $5.75.

Declassified 11 Sep 1973.

The most significant development which occurred during the fabrication of NRX A-3 fuel elements was the improvement in coating adherence at the hot end of the element. Basically, this was accomplished by use of a non-fuel element section cemented to the hot end of the element. During the fabrication of NRX A-2 elements, acceptable coatings, both on the bore surfaces and the end external surfaces, required close parametric control in order to maximize the quality of each surface which was protected. Since parameters for coating non-fueled material are less critical than those for fueled material, application of the non-fueled surface increased the latitude for parametric adjustment to significantly improve external hot end coatings while simultaneously permitting more nearly optimum bore coatings. The initial experiments with the non-fueled tip concept during the latter part of the NRX A-2 production effort were followed by a formal development program during the early part of the NRX A-3 fuel element production effort. The chemical, mechanical, and corrosion test results from these development efforts proved the desirability of using the non-fuel tip. As a result, all elements for the NRX A-3 reactor were made using this configuration. Another significant development was the peripheral coating (O.D.) of all of the Code 32 and 39 fuel elements. This requirement was based on improving the corrosion resistance of the external surfaces of the peripheral elements adjacent to the core filler strips. Compared to the fuel elements made for the previous reactors, the design of the NRX A-3 fuel elements included many new and more stringent requirements. These requirements resulted in new inspection techniques which in turn pointed out new problem areas. The NRX A-3 Program requirements are outlined, and the difficulties encountered and solutions achieved to satisfy these requirements are summarized. (auth)

23859 (WANL-TME-1294) INTERIM REPORT ON THE EXPERIMENTAL INVESTIGATION OF FISSION PRODUCT DIFFUSION. Rymer, G. T.; Henniger, W. A.; Grandy, G. L.; Winowski, W. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 53p. Dep. NTIS $5.75.

Declassified 11 Sep 1963.

The prime objective of the Fission Product Diffusion Program was to provide experimental data on the diffusion of fission product nuclides in NERVA fuel as a function of time and temperature, geometry, and fuel material. The experimentally determined diffusion constants are used in analytical codes to predict the magnitude of fission product release from the NERVA reactor under accidental and normal operating conditions. In order to test the validity of releases predicted by the analytical codes, during accident conditions, experiments have been run using a clustered assembly of fuel elements intended to represent the NERVA reactor during post-operational loss of coolant conditions inhibitory effects of NbC resulted in a prediction of fission product release which was approximately 400% higher than the measured release. A post-operational, radiochemical analysis of samples from the NRX-A3 reactor was made to provide fission product release data for comparison with code predictions for normal full power reactor operation. (auth)

23860 (WANL-TME-1350) NRX-A6 DESIGN REVIEW PRESENTATION, 21 DECEMBER 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1965. 32p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

Material (slides, diagrams, graphs) presented at the design review is documented. (LTN)

23861 (WANL-TME-1391) NRX-A5 ELEMENT PLACEMENT AND ORIFICING SUMMARY REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 100p. Dep. NTIS $8.00.

Declassified 10 Sep 1973.

Pertinent data for the NRX-A5 (ND 10501) reactor core is presented in tabular form. The physical location of elements, nuclear shimming, instrumentation, number and sizes of orifices, corrosion batch information, element weight, and a summary of important thermal characteristics of each element are included. (auth)

23862 (WANL-TME-1419) TEST PROGRAM FOR SUPPORT OF NR-1 REACTOR DEVELOPMENT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 51p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

At present the NR-1 reactor design features a 5000 MW power level, high-void fuel, counterflow cluster support, beryllium ring combined reflector, a flight-type shield, and a flight-type actuator system with gauged drum drive mechanism. The object of the tests described is to complete the development and reactor qualification of these and other features for NR-1. The description is directed mainly toward defining the test data requirements for all the tests that can be foreseen at this time. This covers both tests in connection with specific reactor components, as well as those intended to increase the general level of knowledge in such areas as friction, corrosion, thermal contact resistance, material information, etc. The need for some of the tests (such as those in connection with a fueled element thermocouple installation) is dependent on a number of contingencies, and they may be deleted at a later date. On the other hand, requirements for additional tests will probably arise as the design progresses, and as the results of future NRX-A reactor tests become available. (auth)

23863 (WANL-TME-1423) STRESS ANALYSIS: NRX-A5. Eggers, A. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 61p. Dep. NTIS $6.25.

Declassified 10 Sep 1973.

The analyses performed to determine if the NRX-A5 is structurally capable of withstanding the conditions which will be imposed on it during the forthcoming test are summarized. Since the NRX-A5 does not differ markedly from the NRX-A2 through NRX-A4 reactors which survived power tests and restarts without serious damage, the basic NRX-A5 design has been demonstrated to be adequate. Local cracking of support blocks at the fillet radius of the support seat counterbore has been a problem in NRX-A2 through NRX-A4 reactors. The modified NRX-A5 block design is still considered marginal with respect to fillet stresses. The present status of analysis of the irregular peripheral support blocks is discussed. It is recommended that planned shutdown ramp rates be limited to prevent axial cracking of these blocks. The calculated sector stress at full power, steady state is below 80% of the current best estimate of the irradiated strength. The unfueled partial elements at the core periphery are cooled in NRX-A5. This increases the stress in these elements during startup by 30%. No failures are anticipated since the strength of these elements is still 50% higher than this new stress. (auth)

23864 (WANL-TME-1426) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON APRIL 28, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 39p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

Tests are reported in support of the NRX-A5, NRX-A6 and XE-PRIME reactors and involved supports, seals, fuel elements (including porosity measurements) and other reactor components. Thermal shock and tensile properties measurements on beryllium were carried out. (LTN)

23865 (WANL-TME-1428) PROPOSED REVISION AT WALTZ MILL SITE (WANHES) FOR FUEL ELEMENT CLUSTER TESTING. Ramp, R. L.; Gilchrist, M. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1966. 11p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Full power hydrogen corrosion testing of fuel element clusters is required for the development of the NERVA reactor fuel assembly and core components. At present, cluster testing can be done only at the WANL Large Site and is facility-limited to approximately half power and half flow conditions. The limited amount of development testing already accomplished has yielded valuable results. This work has verified the integrity of the support block assembly design. It has resulted in material changes and design improvements for the support block insulating cup. The development of successful chucks to carry the electric power to the cluster has indicated that full-power testing by electrical resistance heating is possible. The WANL reactor design activity is looking to the corrosion testing of full clusters to proof-test their design of fuel element components and configurations for NERVA. This proposal recommends the increase in capability of the Waltz Mill Site by the design and construction of a new cluster corrosion test furnace with the necessary gas and water flow systems and an increase in the present heater power supply to accommodate full power testing. This proposal also recommends the revision necessary for simultaneous operation of the two single element furnaces in the Waltz Mill Hydrogen Test Cell. (auth)

23866 (WANL-TME-1435) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON 26 MAY 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 34p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

Tests in support of NRX-A5, NRX-A6 and XE-PRIME reactors involved seals, supports, fuel elements and fuel element clusters. Measurements of thermal shock and tensile properties of beryllium were made. (LTN)

23867 (WANL-TME-1441) SUMMARY FABRICATION REPORT FOR NRX-A5 FUEL ELEMENTS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 13 Jun 1966. 39p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The fuel element materials and processing procedures for the final NRX-A4 elements were utilized for the initial NRX-A5 elements. The most significant change in raw materials which occurred during fabrication of these elements was the introduction of Great Lakes Carbon Type W graphite flour and the reintroduction of Minnesota Mining and Manufacturing Co. fuel beads. A change in design reflected by increased length of the non-fuel tip made it necessary to fabricate non-fuel tips from extruded stock. Initial dimensional data identified the need for improved tip stock and tipping techniques. Efforts were continued to improve element and block coating fixturing. Significant improvements were made in O. D. coating fixturing which resulted in a dramatic reduction in chipping defects. In block coating, fixture modifications enabled coating of blocks with no uncoated surfaces. Changes in specifications which made it necessary to measure cement joint porosity were introduced. This and continued tightening of coating chip defect limits reflected more stringent requirements being placed on element quality. The NRX-A5 program requirements are outlined as defined by WANL Production Control work orders and the difficulties encountered and the solutions achieved to satisfy these requirements are summarized. (auth)

23868 (WANL-TME-1447) NRX/EST DISASSEMBLY AND POSTOPERATIVE EXAMINATION REPORT. Figenbaum, E. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 37p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The disassembly and postoperative examination of NRX/EST (A4) was performed at the R-MAD area of NRDS. The performance of each type of sensor is discussed and the operations of the post electrical check, disassembly and postoperative examinations are described. A particularly careful examination was applied to new innovation methods and techniques employed during the installation and assembly of this reactor. The test, disassembly and post-operative examination indicates the WANL-supplied sensors in this reactor performed extremely well. (97.4 percent were operational at the conclusion of all testing). (auth)

23869 (WANL-TME-1449) UPGRADING OF THE SINGLE ELEMENT HYDROGEN CORROSION TEST. Scherer, P. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 22p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

A hardware development program was undertaken to upgrade furnace performance for the single element hydrogen corrosion test. Development of a spring-loaded, segmented-finger, hot-end-chuck for testing non standard geometry elements is described. Improvement in the direct gas inlet chuck for pinhole testing and long cold chucks to shape test temperature profiles are discussed. A nine view port furnace and four view port instrumentation ring were constructed to facilitate the collection of additional test temperature data for analytical purposes. (auth)

23870 (WANL-TME-1452) DEVELOPMENT OF DRUM LIMIT FOR NRX-A5 EP-IV PRESENTATION TO SNPO-C, 20 JUNE 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 50p. Dep. NTIS $5.50.

Declassified 10 Sep 1973.

At the end of NRX-A5 EP III, the reactor had operated for 38 percent of the planned time. A careful study of the changes in diagnostic measurements in NRX-A5 to this point, as well as comparison with the previous behavior with time of NRX-A3 and NRX-A4-EST, led to the conclusion that no anomalies had been observed and that the test article was ready for further testing. Then, based on the estimated rate of fuel element corrosion and the changes in reactivity (based on fuel element corrosion and extrapolated control drum position), a control drum limit for the EPIV test was determined. (LTN)

23871 (WANL-TME-1497) LABORATORY STUDIES OF NERVA MATRIX MATERIALS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 85p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

NERVA fuel element matrices were studied in which relatively small amounts of additives were included, and in which changes in processing techniques were incorporated. The role of each processing step and matrix component studied is defined and discussed from the standpoint of its influence on the matrix. Experimental emphasis was on: (1) mixing, (2) wetting agents, (3) graphitizing catalysts, (4) particle size distribution, (5) binder, and (6) binder catalyst. Some experimental work was carried out on the filler, refractory carbide additions, and graphite flour agglomerates. It is inferred from the experimental data that a less permeable bare matrix is more resistant to hydrogen corrosion at a temperature of about 1500°C. It was found that a more dense (less permeable) matrix can be achieved by intensive mixing. Silicone glycol copolymers consistently reduced the matrix weight loss during hot hydrogen tests. Results at 1500°C indicated that the use of these additives may reduce hydrogen attack on the bare matrix by a significant amount. (auth)

23872 (WANL-TME-1499) FUEL ASSESSMENT PROGRAM, PHASE I: INTERIM REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 253p. Dep. NTIS $15.75.

Declassified 10 Sep 1973.

Phase 1 of the Fuel Assessment Program had the following objectives: (1) To determine the differences in behavior of fuel elements which used nominal NbC coating and those elements which had, in addition to the NbC coating, a subsequent molybdenum coating; (2) To differentiate between the general behavior of the fuel elements produced at WAFF and the Government facility at Y-12; and (3) To determine the effect of variations in the helium pressure external to the fuel elements during electric tests. It was planned to obtain two sets of approximately 30 elements each from both manufacturing facilities. In each set approximately 50 percent of its number would be coated normally, and the remainder would have the additional molybdenum coating. These elements would be evaluated for weight loss, failure time, and pinholing tendencies as a function of the external pressure. The results of the program (phase I) are given; they are rather complex and not susceptible to easy interpretation. (auth)

23873 (WANL-TME-1509) NRX-A5 SENSOR DISASSEMBLY AND POST-OPERATIVE EXAMINATION REPORT. Margulies, A. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1966. 55p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

The post test condition of WANL-supplied sensors is described as obtained during disassembly and post-operative examination of NRX-A5. The operations of the post test electrical check, disassembly inspection, and various means of post-operative examination are discussed briefly. The post test condition of each type of sensor was correlated with the performance of these sensors during the NRX-A5 test series. Particular attention was given to the few sensors that had not performed satisfactorily during testing operations and to those which involved innovations. The test, disassembly, and post-operative examination confirm that the WANL-supplied sensors in this reactor performed extremely well. This is reflected by the fact that the total number of channels operating at the conclusion of all testing represented 95% of the required instrumentation. (auth)

23874 (WANL-TME-1529) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT CLEVELAND ON SEPTEMBER 29, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 40p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

Tests were mainly in support of NRX-A6 and XE-1 reactors and involved fuel elements (tensile properties of corroded fuel elements, creep, porosity, etc.), supports, seals, reflector pressure drop, core effective gap testing, and friction measurements. (LTN)

23875 (WANL-TME-1544(Rev.2)) NRX-A6 DEVELOPMENT PROGRAM (REVISION NO. 2). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 20p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Development programs in support of the NRX-A6 reactor involve: seals, supports, fuel elements, thermocouples, characteristics of pyrofoil, etc. PAX critical experiments to determine the reactivity, control drum worths and power distribution are also discussed. (LTN)

23876 (WANL-TME-1553) NR-1 FUEL ELEMENT SIZE STUDY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Dec 1966. 41p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

A study has been performed to determine the effect of variation of the NR-1 hexagonal fuel element, across-flat dimension and void fraction on the reactor sub-system thermal, nuclear, corrosion and mechanical performance. The studies were performed for a range of the hexagonal-shaped fuel element, across-flat dimensions from 0.65 inch to 1.50 inch. The fuel was evaluated at three different void fractions i.e., the NRX (.29) void fraction, the reference NR-1 (.37) void fraction, and a .5 void fraction that duplicates NRX mass velocities at NR-1 flowrates and core size. Results of the analysis are presented on the basis of the existing 19 channel element, as well as a 37 channel element (which represents the addition of a ring of holes) and a 7 channel element (which represents the elimination of a ring of holes from the present reference design). The purpose of the study was to determine if possibly improved fuel element corrosion performance could be obtained by a change in element geometry, on the basis of presently available knowledge of fuel element corrosion. The calculations were performed for given NR-1 reactor conditions and listed restraints. (auth)

23877 (WANL-TME-1557) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON DECEMBER 21, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 39p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

Tests, mainly in support of XE-1 and NRX-A6 reactors, involved fuel elements (permeability, corrosion), fuel element clusters, supports, seals and fasteners. (LTN)

23878 (WANL-TME-1558) STUDY OF VARIOUS HEATING METHODS FOR HIGH TEMPERATURE TESTING OF FUEL ELEMENTS. Chi, J. W. H.; Ramp, R. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 40p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

NERVA fuel elements have been tested in high temperature furnaces by resistance (or ohmic) heating of the fuel elements. Although the axial temperature distribution obtained simulates fairly closely that of the reactor, the cross-sectional temperature distributions are known to be different. This difference has been suspected to be a prime source of difficulty in obtaining a significant correlation between the corrosion performance of furnace-tested elements and that of reactor-tested fuel elements. As a consequence, other types of furnace heating methods have been suggested. Several possible methods are studied. The effect of various modes of heating on the cross-sectional temperature distributions were analyzed with the aid of a TOSS model. The advantages and disadvantages of the various methods are discussed. It was concluded that both induction and radiation heating are unsatisfactory and impractical. Passive heating is useful for the study of local conditions only, but the cross-sectional temperature gradients are in reverse to those observed in the ohmic heated elements. In-pile heating is obviously the ideal method. However, the high cost of testing and the slow turn-around time precludes a serious consideration of this method. It was concluded that ohmic heating is still the most practical method for large-scale testing of fuel elements. (auth)

23879 (WANL-TME-1564) FEASIBILITY OF A PYROLYTIC PROCESS FOR MANUFACTURING ZIRCONIUM CARBIDE GRAPHITE COMPOSITE SUPPORT CUPS. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1967. 31p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

The feasibility of pyrolytically co-depositing a 10 to 15 weight percent zirconium carbide-graphite composite support cup was demonstrated. Some material with 10-15% ZrC was deposited in the last of a series of 5 furnace runs. Sufficient information was generated that the furnace array process conditions and furnace monitoring were reasonably well established for any future work. Adherence to the mandrels was a major problem. The first deposited material, that with a very high ZrC content, could not be slipped off the mandrel, and it was necessary to bore the mandrel out. Physical integrity of the cups was poor, primarily because of stresses resulting from the variation in ZrC content across the wall of the cups. Process and equipment problems unfortunately plagued each of the furnace runs, and material varied from pure pyrolytic graphite to 47 w/o ZrC. The 10-15% material turned, drilled and bored similar to pyrolytic graphite, being only slightly harder than normal pyrolytic graphite. In any future work, mandrels should be placed around the periphery of the furnace only. Pressure should be slightly increased for obtaining a highly renucleated microstructure. Furnace seals and temperature control of the halide vaporizer must be fool proof. Precoating techniques should be utilized to allow easier removal of mandrels from the deposit. It is further recommended that the composition be targeted to 30 w/o Carbide-70 w/o graphite composite. (auth)

23880 (WANL-TME-1576) XE-1 ELEMENT PLACEMENT AND ORIFICING SUMMARY REPORT. Agosti, R. J.; Cort, G. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 Feb 1967. 249p. Dep. NTIS $15.50.

Declassified 10 Sep 1973.

Pertinent data for the XE-1 (ND-11101) reactor core are presented in tabular form. The physical location of elements, nuclear shimming, instrumentation, number and sizes of orifices, corrosion test results of coating batches, element weight, production type and a summary of important thermal characteristics of each element are included. (auth)

23881 (WANL-TME-1609) INTERIM REPORT ON FISSION PRODUCT DIFFUSION FROM NERVA FUELS. Rymer, G. T.; Henniger, W. A.; Roesmer, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1967. 64p. Dep. NTIS $6.25.

Declassified 10 Sep 1973.

An accurate prediction of fission product release during reactor testing requires data on the diffusion rates of various nuclides in the specific fuel used in the reactor. An experimental diffusion study on different fuel types has been conducted. The various fuel types have the common feature of UC_2 dispersed in a graphite matrix, but the physical form of the UC_2 has undergone several changes. The original fuel, called admixture or Type I fuel, consisted of small crystallites of UC_2 distributed in graphite. This fuel was used by LASL in the first KIWI-A reactors. Measurements of the rate at which fission products diffused in this admixture fuel were determined by a post-irradiation, thermal anneal technique. A significant change in the fuel resulted with the introduction of pyrolytic carbon-clad UC_2 beads or Type II fuel which was used in the NRX-A2 and A3 reactors. Diffusion studies on this Type II fuel indicated a substantial inhibition of fission product release as a result of the dense pyrolytic graphite surrounding each bead. The latest modification, triplex fuel, will be used in NRX-A6. It consists of an isotropic deposit of pyrolytic graphite surrounding each UC_2 bead. Fission product diffusion rates in triplex fuel, which will be applicable to NRX-A6, have been measured. As a result of these studies, the following conclusions can be made: The degradation temperature for enhanced fission release in triplex fuel is 2350°C, which is about 150°C higher than degradation in previous NERVA fuels. Fission product release from triplex fuel is less than from previous NERVA fuels. The relative rates of release of the fission product elements from triplex fuel have been determined. Xenon release from triplex fuel is characterized by a two step mechanism. The use of Nb metal on the fuel beads as a barrier coat for fission product release is ineffective and perhaps deleterious. The relative release of fission products in degraded or Type III fuel, can be described by theoretical expressions for diffusion and solubility of fission products in graphite. (auth)

23882 (WANL-TME-1612) DESTRUCTIVE TEST RESULTS OF NRX-A5 FUEL ELEMENTS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1967. 56p. Dep. NTIS $6.00.

Declassified 10 Sep 1973.

The raw materials (including fuel beads), the major processing operations, and resultant matrix properties of NRX-A5 elements were quite similar to those of NRX-A4. The major changes in A-5 fuel elements compared to A-4 were increasing the coating thickness in the midband and switching entirely to 1 inch long tips back coated 2 to 2½ inches. The experimental elements in NRX-A5 considered to be most interesting were the one-step NbC coatings, the molybdenum brazed tips, and the molybdenum overcoated elements. It is apparent that the NRX-A5 elements did not represent an improvement over the NRX-A4 elements. In fact, they were worse in the critical midband region. The importance of factors such as element body leakage, thermal expansion, fuel beads, flour characteristics, coating deposition temperatures, etc., are recognized as factors which must be controlled in order to improve fuel element performance. The results of the NRX-A4 and NRX-A5 reactor tests dramatically demonstrated the need for improved corrosion performance in the midband region of the fuel elements. This problem, coupled with the need for improved pinholing performance has been studied extensively during the A6 fuel assessment program. Recent fuel element test results indicate that substantial progress has been made in all the critical problem areas. The use of molybdenum metal overcoating in the critical midband area promises to extend core life under NRX-A6 conditions upwards of sixty (60) minutes. The use of lower coating temperatures, a better (lower leak rate) matrix, and controlled NbC thickness profiles give strong indications of producing a fuel element with acceptable pinholing characteristics. The use of higher power in fuel element tests (increased from 775 to 900 kW) coupled with reduced helium overpressure relative to the hydrogen bore pressure is expected to provide a quality control corrosion test method which will effectively discriminate element quality. (auth)

23883 (WANL-TME-1613(Suppl.2)) NRX-A6 TEST PREDICTION REPORT. Knecht, W. L.; Rovnak, J. A. (eds.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 110p. Dep. NTIS $8.50.
Declassified 10 Sep 1973.

23884 (WANL-TME-1613(Suppl.3)) NRX-A6 TEST PREDICTION REPORT. Knecht, W. L.; Rovnak, J. A. (eds.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1967. 91p. Dep. NTIS $4.00.
Declassified 10 Sep 1973.

23885 (WANL-TME-1615) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON MAY 4, 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1967. 34p. Dep. NTIS $4.75.
Declassified 10 Sep 1973.
Tests were mainly in support of the NRX-A6 reactor and involved fuel elements, fuel element clusters, seals, support springs, lateral support system, etc. Some measurements were made of the response of beryllium specimens to repeated strain cycles. (LTN)

23886 (WANL-TME-1616) INSTALLATION HISTORY OF XE-1 REACTOR INSTRUMENTATION. Buby, T. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1967. 27p. Dep. NTIS $4.50.
Declassified 10 Sep 1973.
The installation of the instrumentation during assembly of the XE-1 reactor is described. Comments are given about various problems encountered. The instrumentation for the XE-1 reactor was 100 percent functional when it was shipped from Westinghouse Astronuclear Laboratory (WANL). It is believed that the major reasons for obtaining a perfect instrumentation record during the build of this reactor were: (1) Installation of the instrumentation, cable transitioning and reactor assembly build-up progressed at a moderate pace without excessive schedular pressure on assembly personnel. This resulted in a higher quality workmanship level. (2) Improved methods of installation and a better design eliminated problems that occurred on previous reactors. (auth)

23887 (WANL-TME-1624) TFL-LA CLUSTER CORROSION TEST SUMMARY NOVEMBER–FEBRUARY 1967. Stahl, B. H.; Salvador, L. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 May 1967. 60p. Dep. NTIS $6.00.
Declassified 10 Sep 1973.
Progress on the TFL-1.a Cluster Corrosion test from November 1966 to February 1967 is reviewed, including the results of 14 high-temperature flow tests. These tests fall into two categories: Developmental tests of NRX-A6 support components and qualification tests of the XE-1 exit gas thermocouple assembly. The three NRX-A6 configurations include an ATJ graphite protection cup, a vapor deposited tungsten protection cup, and a niobium carbide composite protection cup, all with skirtless support blocks. The XE-1 thermocouple assembly was qualified in a nominal 35 minute test at 4300°R. The NRX-A6 components performed adequately in endurance tests of 60 minutes at 4300°R. (auth)

23888 (WANL-TME-1636) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JUNE 8, 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1967. 55p. Dep. NTIS $5.75.
Declassified 12 Sep 1973.
The tests were mainly related to tests of fuel elements and fuel element clusters for the NRX-A6 reactor. Tests of seals, supports, and beryllium neutron reflectors are also reported. (LTN)

23889 (WANL-TME-1661) EVALUATION OF NERVA ENGINE ATTITUDE ON THE EFFECTIVENESS OF A POST OPERATIONAL DESTRUCT SYSTEM. Hargrave, H. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1967. 59p. Dep. NTIS $6.00.
Declassified 12 Sep 1973.
The effect of engine attitude on the capability of a reference ordnance destruct system to function as an effective safety countermeasure was examined for two suborbit start missions. The criterion of effective performance stipulated that the reference destruct system be capable of preventing any debris hitting Africa if a failure occurred during the time span when the reactor would otherwise re-enter onto the African continent. The results obtained indicate that with proper attitude control, utilization of destruct can prevent, for a limited time, the contamination of the African continent. However, in all cases the attitude-fail time envelope rapidly diminishes with increasing rocket time, and it was ascertained that the reference destruct system wan incapable of preventing impact of radioactive debris on Africa throughout the entire failure time span of interest for all missions investigated. (auth)

23890 (WANL-TME-1708) WESTINGHOUSE ASTRONUCLEAR LABORATORY CONTRIBUTION TO THE TWENTY-FIFTH HIGH TEMPERATURE FUELS COMMITTEE MEETING DECEMBER 5-7, 1967. Fleischer, L. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 42p. Dep. NTIS $5.25.
Declassified 14 Jul 1975.
NRX-A6 fuel elements were coated with niobium carbide which cracks on cooling. They were then overcoated with molybdenum deposited at a low temperature to close the cracks in the NbC. An electrical test used for the development and qualification of fuel elements is described. The XE-PRIME reactor was assembled in April 1967, inerted with 8 psig helium and shipped to the Nevada Test Site. When opened in mid August, about 45 g of fuel element debris was found. After intensive laboratory study it was concluded that exposed UC_2 had hydrolyzed in the interval as a result of the traces of water present (possibly sensitized by small amounts of chloride ion). Composite material (NbC plus graphite) was investigated as a means of improving fuel element coating retention. The creep behavior of refractory metal monocarbides was studied as a basis for high carbide composites and alloy carbide development. (LTN)

23891 (WANL-TME-1713) REACTIVITY PREDICTION AND REACTIVITY SHIMMING SPECIFICATION FOR THE NRX-A6 REACTOR. Hill, D. J.; Seibert, C.; Iwinski, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Nov 1967. 109p. Dep. NTIS $8.50.
Declassified 14 Jul 1975.
The reactivity of the NRX-A6 reactor was calculated relative to the PAX-E1 reactor at WANEF, which incorporated the NRX-A6 reflector rings and control drums. In determining the relative reactivities of NRX-A6 and PAX-E1, the core material inventories for the two reactors were determined with the Automated Materials Data System (AMDS) computer program. The non-core material inventories were based on the measured masses of the individual components involved. The reactivity difference between the NRX-A6 and PAX-E1 fuel was determined by (a) experimentally measuring the reactivity change which occurred when NRX-A6 preproduction fuel was substituted for a quadrant of PAX-E1 fuel, (b) multiplying this reactivity change by a calculated factor which was approximately four, and (c) correcting the results for quadrant interaction effects. Where applicable, core reactivity changes were taken to be the product of the mass difference and the appropriate reactivity coefficient at the location of the element. The mass differences were determined on an element-by-element basis. The reactivity coefficients were determined by interpolation of radial reactivity coefficient curves. The reactivity differences for non-core materials were also calculated for the

most part by applying reactivity coefficients to measured mass differences. (auth)

23892 (WANL-TME-1798(Vol.5)) RADIATION ANALYSIS. Capo, M. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Jun 1968. 187p. Dep. NTIS $12.50.

Declassified 14 Jul 1975.

Radiation Analysis is one of seven volumes prepared to support the Engineering Data and Design Concept Meeting on the NERVA I Program. It presents the Radiation Analysis of the NERVA I reactor and those major structural components defined as Engineering Critical Components (ECC). The chapter on the nuclear reactor includes a review of the Nuclear Subsystem radiation requirements and a discussion of the NSS Nuclear and Radiation Environment Drawing which will be utilized to present the key environmental conditions for all operating and non-operating conditions. This chapter also contains the over-all radiation characteristics of the reference nuclear reactor. A chapter is devoted to the radiation analysis performed on the candidate designs for each ECC. These chapters include a summary, the radiation requirements as given in the ECC and an analysis section. This latter section includes the methods, key assumptions, analysis results and the pros and cons from the radiation standpoint of each of the designs being evaluated. (auth)

23893 (WANL-TME-1798(Vol. 7)(Pt. 1)) COMPONENT TEST PROGRAM, VOLUME 7. Part I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Jun 1968. 381p. Dep. NTIS $22.25.

Declassified 11 Sep 1973.

Volume 7 is one of seven volumes prepared to support the planned Engineering Data and Design Concepts Meeting on NERVA I. The overall component test program needed to verify the specification requirements for each Engineering Critical Component (ECC) is defined. Volume 7 consists of a compilation of descriptions of tests and test rigs related to the technical requirements of particular specifications and is divided into major sections corresponding to the major testing laboratories at WANL. (auth)

23894 (WANL-TME-2689) EVALUATION OF THE WANL INTEGRATED NUCLEAR, RADIATION, AND SHIELDING STANDARD DESIGN METHOD (WISDM). Volume 2. Ortenberg, L. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 65p. Dep. NTIS $6.25.

Declassified 14 Jul 1975.

The WANL Intregated Nuclear, Radiation and Shielding Standard Design Method (WISDM) used in nuclear and radiation design and analysis of the NERVA Nuclear Subsystem is described. An evaluation of the accuracy of the WISDM methods and techniques is made by comparison with experimental results. WISDM is an integral part of an overall Design Engineering Method being developed to automate the mechanical, thermal, structural, nuclear, and radiation analyses and design of the NERVA Nuclear Subsystem. Methods related to predictions in the following nuclear, radiation, and shielding analysis areas are discussed: (1) absolute reactivity (for component sizing or fuel loading), (2) control drum worth, (3) fission distribution (for fuel zoning or coolant allocation), (4) material reactivity worth (for evaluation of the effect of non-nominal compositions or conditions), (5) shield performance, (6) radiation heating rates (for component cooling requirements), and (7) radiation environment (for radiation damage). Volume 1 describes the WISDM techniques, evaluates the accuracy of the techniques by comparison with applicable experimental data, and discusses areas requiring improvement. Detailed statistical evaluation of the comparison of experimental and calculated results is presented for the methods used in calculating control drum worth, fission distribution, shield performance, radiation heating rate, and radiation environment. Volume 2 describes the reactor systems evaluated by WISDM. (auth)

23895 (WANL-TME-2750) FISSION PRODUCT DIFFUSION FROM NERVA COATED COMPOSITE FUEL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 32p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

During reactor operation, a portion of the fission products will be released from the fuel material by diffusion to the coolant channels and will be carried out of the reactor with the propellant. Experiments in the past were conducted in the laboratory on beaded type fuel to develop diffusion constants which were used to predict fission product release from testing of reactors using that type of fuel. A new type composite fuel is currently being considered for use in reactors for the nuclear rocket program. Preliminary results of experiments to measure fission product diffusion in composite fuel indicated that fission product release was far greater from composite fuel than from beaded type fuel. A series of experiments was therefore conducted, using the available composite fuel material, to accumulate the necessary release rate data to develop diffusion constants. The diffusion constants will subsequently be used in the FIPDIF computer program to predict fission product release from reactor testing. Additional experiments will be required to modify these diffusion constants as fuel matrix materials and coatings are improved. (auth)

23896 (WANL-TME-2770(Vol.2)) RELIABILITY ALLOCATIONS ASSESSMENTS AND ANALYSIS REPORT. Nuclear Subsystem. Volume II, Chapters 7–10. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 522p. Dep. NTIS $29.25.

Declassified 12 Sep 1973.

Reliability allocations, assessments and failure mode analysis are provided for the following NERVA engineering critical components: shields, neutron reflectors, control drum drives, and the structural support coolant assembly. (LTN)

23897 (WANL-TME-2771) WANL CONTRIBUTION TO THE 31ST HIGH TEMPERATURE FUELS COMMITTEE MEETING, 8–10 DECEMBER 1970. Simmons, C. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1970. 86p. Dep. NTIS $7.50.

Declassified 14 Jul 1975.

The results of limited postoperational examinations and analyses performed on XE Prime fuel elements are described. Fuel performance was generally good with moderate weight losses, low pinhole densities, light surface corrosion, no interelement bonding, and very little corrosion weakening. Weight losses and bore corrosion in the hot end region were somewhat higher than predicted with losses, bore corrosion, and pinhole densities tending to be highest in Y-12 bore coated elements. Bore corrosion was predominantly by ring corrosion with some corrosion pocket formation indicating influence of cyclic and low power testing. Some minimal hydrolysis damage could have occurred in the Y-12 bore coated elements. Mild "notch" pattern corrosion occurred on some peripheral fuel elements. Element fracture due to corrosion weakening occurred predominantly on peripheral elements with this type of corrosion. Some corrosion of the exit faces of fuel elements occurred due to "sticking" to support block faces. There was a general tendency for the niobium carbide back coats to be nonadherent after test. (auth)

23898 (WANL-TNR-026) NERVA B-4 REACTOR, PHASE I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1962. 27p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

Using the KIWI B-4 reactor designed by Los Alamos Scientific Laboratory as part of the ROVER Program as a basis, a proposed B-4 reactor designed for flight is described. The effects of the flight requirement on the Los Alamos design are discussed: The reactor core and the reflector must be capable of carrying acceleration loads in all directions, so a major revision of the reactor support structure is required, especially lateral support. Shielding will be required. The reactor instrumentation will be rather different due to the more involved requirements. (LTN)

23899 (WANL-TNR-070) TOXICITY OF NERVA REFLECTOR MATERIAL FOLLOWING A LAUNCH PAD ACCIDENT. Goodman, E. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1962. 162p. Dep. NTIS $11.25.

Declassified 14 Jul 1975.

Experimental and analytical work was performed to allow the source term for airborne beryllium to be estimated under the extreme conditions resulting from a launch pad fire. Graphs and tables are presented from which it is possible to evaluate the possibility of Be becoming airborne if the heat flux into the Be reflector and the duration of this flux are known. The experimental work consisted primarily of studying beryllium-flame reactions and beryllium-water reactions. The results indicate that beryllium can become airborne in a prolonged fire if surface temperatures in the neighborhood of the melting point (1283°C) are reached. Flame temperatures in excess of 2000°C were reached in the experimental work. Data on flame temperature in a launch fire and its duration are required before final conclusions can be drawn on the magnitude of the beryllium release, but present indications are that massive Be will not reach the threshold surface temperatures in a realistic incident. Although massive Be will not reach this condition, additional information should be reviewed as it becomes available on the fragmentation of the beryllium reflector since the quantity becoming airborne is quite sensitive to the beryllium area exposed and the surface to mass ratio. It is unlikely that the threshold Be surface temperatures

reached in the laboratory are duplicated in an accident and it would take an extended period under these conditions to create an excessive downwind Be concentration. For the pessimistic Be release rate assumed it would take almost three hours (164 minutes) after reaching the threshold surface temperature to achieve 1% reflector release. In the study of the reactions of beryllium with water, the beryllium becoming airborne was negligible as compared with the flame reactions. (auth)

23900 (WANL-TNR-097(Rev.0)) PRELIMINARY NRX-A1 TEST PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1963. 102p. Dep. NTIS $8.25.

Declassified 14 Jul 1975.

The NRX development program consists of a series of full-scale reactor tests supported by interrelated programs of analysis and component testing, whose goal is the development of a reactor suitable for flight. Three principles have guided the formulation of this program: A combined component and analytical program will be conducted which will establish an understanding of component and system behavior; the high cost and long lead time requirements of full-scale tests dictate that they not be performed until analysis and component testing assure a high probability of success; and early full-scale tests are highly desirable to explore problem areas which are only found under the combined environments achieved in actual operation. The NRX-A Block I reactors were frozen on the basis of preliminary analysis and data from the KIWI-B4A test. There are a number of areas requiring verification in this design, including the following: Assurance that the core and support system are free from mechanically destructive self-excited vibrations, and will withstand externally generated vibrations; prevention of excessive temperature gradients in the core periphery and inner reflector regions; insurance of adequate cooling and integrity of the tie rods which provide axial support to the core; provision of an adequate seal to prevent excess coolant leakage around the core; the design of a balanced pressure seal design requires detailed knowledge of leakage paths between fuel elements; performance of the beaded fuel—mainly reactivity changes and dimensional integrity; and measurement of the corrosion of fuel and structural components. The NRX-A1 (cold flow reactor) Test Plan is the first of a series of test plans and other related documents required for the NERVA Program. Using the Test Plan as an overall control guide, a Test Specification will be prepared which will convey to the test organization the methods, parameters, special precautions, data requirements and other pertinent information to meet the design, manufacturing, quality assurance and reliability requirements to further the knowledge and meet the objectives of the NRX Program. (auth)

23901 (WANL-TNR-099(Suppl.1)) SAFETY REPORT FOR THE FLEXIBLE CRITICAL EXPERIMENT. Vachon, L. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Feb 1965. 41p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

Addition information is provided in support of a request for approval to operate a new critical assembly known as the Flexible Critical Experiment (FCX). The flexibility desired in the FCX critical assembly is met by a change in its mechanical design as compared to the PAX-PTX reactors. A detailed description of FCX reactor components and support hardware is presented. The major portion of site and facility description supplied in WANL-TNR-099, "Safety Report for the WANEF" is applicable to the FCX critical assembly. Those changes required in the test cell and control system to accommodate the FCX are described here. The procedures that will enhance the safety of operation of the facility are summarized. A discussion of the safety problems associated with operation of the FCX assembly is presented. The maximum credible accident for the FCX assembly, based on an operating limitation on excess reactivity, is produced by a 0.50$ reactivity insertion. Analysis demonstrates that response of the core during the resulting transient is sufficiently slow that either automatic or manual scram will be initiated before a significant core temperature rise can occur. It is concluded that the mechanical/nuclear design of the reactor assembly, the nature of the experimental program, and the administrative controls imposed on reactor operations are such that the FCX facility will not present any nuclear hazard to the general public. (auth)

23902 (WANL-TNR-101) KIWI B-5 SHIELD AIR FLOW DISTRIBUTION TEST. Black, D. L.; Rieke, K. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Apr 1963. 106p. Dep. NTIS $8.50.

Declassified 14 Jul 1975.

Air flow tests were conducted on a full scale 60° sector model of the KIWI B-5 radiation shield. The purpose of these tests was to assure that no region of flow starvation exists, and to establish the flow distribution and the associated pressure losses throughout the model. Tests were conducted at four airflow conditions yielding nominal Reynolds numbers of 2000, 5000, 10000 and 14000. The results of these tests are summarized. (auth)

23903 (WANL-TNR-112) VIBRATION TEST OF AN ELECTROPNEUMATIC ACTUATOR: BENDIX MODEL ND-D1. Snarponis, W. J.; Sipe, F. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 31 May 1963. 29p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

A Bendix Actuator (Bendix Model ND-D1) was vibrated so that the effects of limited vibration on the actuator performance could be studied. The test results show that the actuator has significant resonant frequencies of 220 cps, 580 cps, and 1700 cps in the horizontal plane and 1800 cps in the vertical plane. Actuator performance under vibration loads was not seriously affected; however, failure of a torque motor electrical connection caused a loss of control and random oscillations of the output shaft. A careful study of the torque motor problem is needed to improve the design and reliability of the component in the operating environment. (auth)

23904 (WANL-TNR-122) EVALUATION OF KIWI HYDRAULIC ACTUATOR FOR NRX-A APPLICATION. Marttila, R. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jul 1963. 65p. Dep. NTIS $6.25.

Declassified 10 Sep 1973.

Tests were conducted on a KIWI-B hydraulic actuator, since the NRX-A actuators are similar to the KIWI-B actuators, to determine whether the actuator meets the NRX-A hydraulic actuator specification (WANL Specification E-675363). The frequency response, transient response, and scram characteristics were determined. The specification requirements were met in all areas and therefore, the use of similar actuators for NRX-A is justified. The design of the various safety features incorporated in the hydraulic system appears sound, namely, the manual and pneumatic locks, velocity limit in the increased reactivity direction, and servo-valve offset for loss of command signal conditions. One area of concern is the possible failure of a feedback potentiometer on the actuator which would result in loss of feedback signal to the control system and cause that drum to go full out. A malfunction analysis of the control system is being made to determine the effects of drum excursion and indicate the potential problems. It should be mentioned that there were no known cases of failure of the feedback potentiometer during the KIWI series of testing. (auth)

23905 (WANL-TNR-124) NRX-A ASSEMBLY STANDS AND FIXTURES DESIGN REPORT. Aducci, S. A.; Moritz, W.; Polinak, D.; Zwillich, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 170p. Dep. NTIS $11.50.

Declassified 10 Sep 1973.

The design of assembly equipment is the technology of providing the specialized equipment required to assemble an item in a safe and efficient manner. The problems faced in developing the equipment required to assemble the NRX-A reactors are discussed. The design criteria and the special requirements developed for the assembly equipment are based on design parameters defined for the reactor, special characteristics of the assembly facility, nuclear safety considerations, extensive analysis, and engineering judgment. The design, structural analysis and functional testing of the assembly equipment was performed by Westinghouse Astronuclear Laboratory (WANL). The fabrication and initial load testing of the equipment was performed by various vendors, working in conjunction with and under the technical direction of WANL. Analysis and tests show that the assembly equipment fully satisfies all the design criteria and special requirements. (auth)

23906 (WANL-TNR-158) PREASSEMBLY EXPERIMENT (PAX) IN SUPPORT OF NRX-A2. Ney, E. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 Jun 1964. 361p. Dep. NTIS $21.25.

Declassified 10 Sep 1973.

The performance of the Preassembly Experiment (PAX) in support of the NRX-A2 provided experimental data that confirmed previous measurements by the Los Alamos Scientific Laboratory (LASL) and verified WANL analytical interpretations of differences between the KIWI type and NRX type reactors. Specifically, PAX provided the data required for shimming and orificing NRX-A2 and provided a basis for the validation of calculational techniques. The most significant results are summarized: The PAX critical drum position was predicted accurately, confirming both the total reactivity calculational technique and the material inventory data. The measured control drum reactivity span was found to be slightly higher than LASL measurements on similar

assemblies. The NRX-A2 tantalum shim system tested in PAX proved satisfactory; no adverse effects on either power or drum span were noted. The measured power distribution agreed to within about eight percent of the post run analysis except in peripheral elements. The measurement of hydrogen worth was in good agreement with the latest LASL worth measurement on similar assemblies. (auth)

23907 (WANL-TNR-167) ANALYSIS OF ALPHA PARTICLE RELEASE FROM PARTICULATE FUEL. Cadoff, L.; Fleischer, L.; Brizes, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 26p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

Mathematical expressions relating experimental alpha count data with the extent of migration in pyrocarbon coated UC_2 particles have been derived. The expressions are based on a simplified model for migration in which the uranium concentration profile in the migration zone is approximated by a step function. Experimental data are shown to agree satisfactorily with the derived equations. It is concluded that alpha counting techniques are applicable, in conjunction with microradiography, to the determination of the uranium concentration in the migration zone and the total weight of migrated uranium. (auth)

23908 (WANL-TNR-171(Suppl.1)) CRITERIA OF THE POST-OPERATIVE CELLS E-MAD FACILITY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Jan 1963. 23p. Dep. NTIS $4.25.

Declassified 14 Jul 1975.

The bases for estimating the number of hot cells required in the E-MAD facility are given. It is assumed that the reactor testing rate will be one per month, the nature and number of specimens of each component to be tested are selected and the nature of the several tests and the time required are used to calculate the number of hot cells required to accomplish this overall task in a month. The estimate is qualified by the observation that engine failures, serious defective component or control equipment deficiencies, or even scheduling perturbations will increase the number of cells required. But the information presented represents the best presently available knowledge of the requirements. (LTN)

23909 (WANL-TNR-188) REVIEW OF NERVA FUEL ELEMENT SURFACE TREATMENT. Wilks, P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1964. 37p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

Current information relating NbC coating process parameters to the nature of the coating produced is reported. The properties of niobium pentachloride are discussed and the theoretical relationship between carrier gas flow and salt flow is presented. A model of the reagent stream is proposed which requires that $NbCl_5$ be reduced to $NbCl_3$ before the reagent stream contacts the fuel elements. The actual deposition step is described as disproportionation of $NbCl_3$ to yeild $NbCl_5$ and NbC in the presence of carbon. The total yield is ultimately limited, at temperatures below 1900°C, by the amount of hydrogen introduced. If the reagent stream is unvitiated and its composition controlled, the NbC coating thickness is determined by the diffusion of carbon through the NbC coating. The relationship of coating thickness to time and coating temperature has been determined quantitatively. It is presented in the form of a family of curves, used to determine process parameters which produce desired coating thickness profiles in the channels of NERVA fuel elements. Recent coating procedures at Los Alamos, Oak Ridge, and Westinghouse are compared and discussed. Current findings are presented which relate fuel element performance to process coating parameters. Future development efforts will be directed to the production of long life fuel elements. (auth)

23910 (WANL-TNR-208) DEVELOPMENT COATING OF UC_2 FUEL PARTICLES. Feild, A. L. Jr.; Monkelis, M. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Dec 1965. 69p. Dep. NTIS $6.50.

Declassified 12 Sep 1973.

A laboratory program was initiated to develop improved pyrocarbon coatings on UC_2 fuel particles which would effectively resist uranium migration at temperatures above 2300°C for periods of several hours. Coating parameters for production of single, duplex, and triplex pyrocarbon coatings were studied using a fluid bed apparatus with methane as the reactant gas in a helium carrier. These coatings were satisfactory at 2300°C for 4 hour exposure times but failed at 2500°C under ½ hour exposure. Further development was aimed at production of doped pyrocarbon coatings using additives which would form dispersed stable carbides in the coating or increase graphitization of the pyrocarbon. Zirconium and aluminum were selected, the former because of a favorable combination of nuclear and chemical properties, the latter because of a demonstrated catalytic effect on graphitization of carbons. Studies using aluminum as an additive were not successful. Low density, fluffy coatings were produced and no graphitization occurred. Migration resistance at 2300°C was inferior to that of normal pure pyrocarbon coatings. The Zr additions were successful in providing good migration resistance at a temperature of 2500°C for periods of 2 hours. Low concentrations of Zr in the particles (0.1–3.0 w/o) were most effective in retarding uranium migration. The optimum coatings consisted of an inner layer of laminar pyrocarbon deposited at 1200°C and an outer granular layer of pyrocarbon doped with zirconium deposited at 1900°C, the total coating thickness being ~25 microns. (auth)

23911 (WANL-TNR-217) PROGRESS REPORT ON LABORATORY COATING STUDIES. Kochka, E. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jul 1966. 54p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

Information obtained in limited studies of the vapor deposition of TaC and ZrC by the hydrogen reduction of $TaCl_5$ and $ZrCl_4$ is presented. The data on TaC describe the deposition as a function of the $TaCl_5$ concentration in the gas stream and show that Ta_2C is present in coatings deposited at 2150°C when the volume of $TaCl_5$ in the gas stream is greater than 2%. The data on ZrC are presented as a function of temperature and disclose that with the gas composition used diffusion-controlled deposition conditions were obtained only at the higher coating temperatures. Low temperature metal deposits formed by the hydrogen reduction of $MoCl_5$ and $NbCl_5$ were investigated as a means of filling the cracks present in high temperature NbC coatings. Molybdenum is found to penetrate into the cracks, but is not adherent to NbC. In the process of depositing molybdenum metal from the chloride, etching of the NbC grain boundaries takes place. A study of hydrogen chloride attack of niobium carbide coatings shows that the attack is inhibited to some extent by the presence of niobium chlorides in the gas stream. In depositing niobium metal over niobium carbide, etched grain boundaries are not in evidence. Although niobium does not penetrate into the cracks the way molybdenum does, it forms a diffusion bond with NbC and bridges over the cracks to seal them. This offers a potential method of increasing the resistance of a NERVA fuel element to hydrogen corrosion. (auth)

23912 (WANL-TNR-406) SPECIFICATIONS AND DRAWINGS FOR CORE ELEMENTS: PLUG CHANNEL CORE. Fields, C. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Nov 1963. 84p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

23913 PROTECTIVE SYSTEM AGAINST ACTIVITY RELEASE. Motzkau, S. (To Gesellschaft fuer Kernenergieverwertung in Schiffgau und Schiffahrt mbH). German(FRG) Patent 2,333,093/A/. 16 Jan 1975. 13p. (In German).

A secondary containment is described which is claimed to make refuelling in ship reactors considerably easier and safer. (GE)

Reactor Safety and Environmental Aspects

Refer also to abstracts 22243, 22266, 22273, 22295, 22298, 22952, and 24055.

23914 (AED-CONF-75-082-002) NUCLEAR POWER STATIONS AND THEIR ENVIRONMENTAL HAZARDS. Jansen, P. (Kernforschungszentrum Karlsruhe (F. R. Germany. Inst. fuer Angewandte Systemtechnik und Reaktorphysik). 1975. 21p. (In German). INIS.

From annual meeting of the Deutscher Verein fuer Versicherungswissenschaft e.V.; Karlsruhe, F. R. Germany (5 Mar 1975).

1 fig.; 2 tabs.; 11 refs.

Starting from a consideration of the energy demand up to the year 2000, the author points out the necessity of nuclear power plant operation for electricity generation and discusses the possible danger to human populations. An assessment of the emission rate of radionuclides in nuclear power plant operation and the possible health hazards to the total population is based on a survey of the U. S. EPA of February 1972. The discussion of the accident risk is based on the results of Rasmussen's study of reactor safety. (GE)

23915 (ANL-CT-75-47) TREATMENT OF CAVITATION BY COLUMN SEPARATION FORMULATION AND PRELIMINARY

RESULTS. Kot, C. A.; Youngdahl, C. K. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 36p. AT.

A column separation model for incorporating the effects of cavitation into the computation of pressure transients in a heat transport system is described. Within the framework of the method of characteristics as applied to fluid hammer analysis, equations are presented for computing column separation at interior pipe nodes and at a variety of junction types. The importance of cavitation effects on magnitudes and time phasings of pressure transients is demonstrated for some example problems. (auth)

23916 (BMI-X-658) HAARM-1 USERS MANUAL. Reed, L. D.; Gieseke, J. A. (Battelle Columbus Labs., Ohio (USA)). 15 May 1975. Contract W-7405-eng-92. 139p. NTIS $5.45.

Safety analysis of Liquid Metal Fast Breeder Reactors (LMFBRs) must include predictions of aerosol release, transport and deposition. Several models have been developed to describe aerosol behavior under postulated accident conditions. Because of their availability and the relative short computer running times they required, the HAA-3 and HAA-3B codes have been used quite extensively for fast reactor safety analyses. The improvement of existing codes was undertaken using the HAA-3B code as a basis and the computer code for the resulting HAA-3B Revised Model (HAARM-1) was developed. The revised model as described differs from previous models in that it includes thermophoretic wall deposition as dependent on particle size, modified settling velocities for agglomerates of individual particles which are dependent on agglomerate size, and particle–particle collision efficiencies which are dependent on particle size. The major improvements in the HAARM-1 code as compared with previous models, are concerned with thermophoretic wall deposition, shape factors for adjusting agglomerate settling velocities, and particle–particle collision efficiencies. 33 references. (auth)

23917 (B/R-001) ANALYSIS OF TORNADO GENERATED MISSILES. Beeth, D. R.; Hobbs, S. H. Jr. (Brown and Root, Inc., Houston, Tex. (USA)). May 1975. 99p. Brown and Root, Inc., Houston, TX.

The objective of this report is to delineate techniques used in the aerodynamic and risk analyses of tornado missile events and to establish missile design velocities which must be accounted for in the design of current commercial nuclear power plants. A probability criteria of 10^{-7}/year was selected for purposes of evaluation. Missile trajectories are generated by aerodynamic analysis of missiles in a conservative design basis tornado. Drag coefficient variation with Reynolds number and vertical velocities due to angle-of-attack lift are included in the analysis. Injection heights considered are 30 ft and 250 ft. Highest missile velocities were found to be generated by an injection position approximately 90^{0} to the right of the tornado path. Missile damage potential is assumed proportional to the normal component of impulse. Effective missile velocities are derived from the normal impulse of off normal missile orientation and velocity. Statistical analysis of velocity and missile orientation probabilities result in a table of effective missile design velocities which satisfy the 10^{-7}/year probability criteria. An estimate of the factors which are neglected in the analysis indicates that the calculated probabilities are conservative by at least two orders of magnitude. (auth)

23918 (CONF-750411-8) DESIGN MARGIN APPROACH IN LMFBR NUCLEAR SAFETY. Graham, J.; Strawbridge, L. E. (Westinghouse Electric Corp., Cheswick, Pa. (USA). Advanced Reactors Div.). 1975. 25p. Dep. NTIS $4.25.

From European nuclear conference; Paris, France (21 Apr 1975).

A new approach recommended for the treatment of core disruptive accidents in LMFBR safety is outlined. In place of the traditional approach in which an extreme assumed core disruption would be treated as a design basis accident for the plant containment, an approach which emphasizes prevention of such events to a confirmable low probability coupled with a margin of protection for unknowns is outlined. In addition, it is shown that the margin of protection may be provided by designing for characterized damage loadings. Recommendations are also made for standardization of these margins through national code committee action. The Clinch River Breeder Reactor is used as an example of the application of such an approach. 15 references. (auth)

23919 (CONF-7310110-, pp 27-31) CRITERIA OF RADIATION PROTECTION AT THE CONSTRUCTION OF NUCLEAR POWER PLANTS. Sevc, J.; Kunz, E.; Námestek, L. (Inst. of Hygiene and Epidemiology, Prague). 1974. (In Czech).

From conference on nuclear power plants and containment; Brno, Czechoslovakia (3 Oct 1973).

In conference on nuclear power plants and containment.

An overall picture is presented on the formation and application of criteria for radiation safety for the building of nuclear power plants in densely populated areas. They stress the need for criteria of protection and propose applicable limits of exposure in CSSR (1.6 man-rem/1MW$_t$ of the installed energy output of nuclear equipment). An analysis of the spectrum of possible accidents and their consequences related to the probability of such accidents appears to be an optimal method for estimating the acceptability of an accident risk in nuclear power plants. Thus far no other criteria but that of genetic effects on the population have been established, but data are being accumulated on the basis of which it will be possible to establish criteria for the assessment of the acceptability of accidents. (auth)

23920 (ERDA-1541(Vol.1)(Dr.)) LIGHT WATER BREEDER REACTOR PROGRAM. Volume I. Summary and Background. Environmental Statement. Draft. (Energy Research and Development Administration, Washington, D. C. (USA)). Jul 1975. 234p. Energy Research and Development Administration, Washington, DC.

An environmental review of the LWBR Program at the Shippingport Reactor is presented. Topics covered include background information on the program, LWBR core operations at Shippingport, commercial application of LWBR technology, cost-benefit analysis, safety, alternatives to the program, and energy forecasts. (JWR)

23921 (ERDA-1541(Vol.2)(Dr.)) LIGHT WATER BREEDER REACTOR PROGRAM. Volume II. Operation of LWBR Core in Shippingport Atomic Power Station. Environmental Statement. Draft. (Energy Research and Development Administration, Washington, D. C. (USA)). Jul 1975. 834p. Energy Research and Development Administration, Washington, DC.

A detailed environmental review of LWBR core operations is presented. Topics covered include effects of construction and operation, monitoring for non-radiological impacts, radiological impact from normal operation, transportation and safeguarding of nuclear materials, accidents, and alternatives to the program. (JWR)

23922 (ERDA-1541(Vol.3)(Dr.)) LIGHT WATER BREEDER REACTOR PROGRAM. Volume III. Commercial Application of LWBR Technology. Environmental Statement. Draft. (Energy Research and Development Administration, Washington, D. C. (USA)). Jul 1975. 663p. Energy Research and Development Administration, Washington, DC.

An environmental review of the commercial application of LWBR technology is presented. Sections are included on the environmental impact of a conceptual LWBR fuel cycle, unavoidable adverse environmental effects, alternatives, the relationship between short-term uses and long-term productivity, irreversible commitments of resources, and cost-benefit analysis. (JWR)

23923 (ERDA-1541(Vol.4)(Dr.)) LIGHT WATER BREEDER REACTOR PROGRAM. Volume IV. Environmental Assessment of a Conceptual Thorium–Uranium Fuel Cycle. (Energy Research and Development Administration, Washington, D. C. (USA)). Jul 1975. 756p. Energy Research and Development Administration, Washington, DC.

An environmental review of a conceptual thorium–uranium fuel cycle for LWBR type reactors is presented. Topics covered include mining, milling, enrichment, fuel fabrication, reprocessing, storage, waste management, transportation, and a conceptual integrated fuel cycle facility. (JWR)

23924 (ETR-1001(Rev.0)) EBASCO NUCLEAR QUALITY ASSURANCE PROGRAM, MANUAL 1166. (Ebasco Services, Inc., New York (USA)). 1975. 161p. Ebasco Services Inc., New York.

A quality assurance program for the design, procurement, and construction activities involving safety related features of nuclear power plants within the scope of work of Ebasco is presented. (JWR)

23925 (HEDL-SA-983) SODIUM-CONCRETE REACTIONS, LINER RESPONSE, AND SODIUM FIRE EXTINGUISHMENT. Hilliard, R. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract AT(45-1)-2170. 51p. (CONF-750719-2). Dep. NTIS $5.75.

From safety technology meeting on radiological consequence assessment; Canoga Park, California, USA (29 Jul 1975).

23926 (HEDL-TME-75-50) ANALYSIS OF THE UNPROTECTED TRANSIENT OVERPOWER ACCIDENT IN THE FTR. Waltar, A. E.; Wilburn, N. P.; Kolesar, D. C.; O'Dell, L. D.; Padilla, A. Jr.; Stewart, L. N.; Partain, W. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-2170. 427p. AT.

A comprehensive analysis of an unprotected transient overpower accident in the FFTF has been performed. A brief description of the basic approach employed, the data base used, the computational methodology utilized, and the results of numerous base and parametric studies is presented. Most of the analysis was carried out for

the Beginning-of-Cycle Four (BOC-4) core configuration, but calculations were also conducted for Beginning-of-Life (BOL) and End-of-Cycle Four (EOC-4) configurations. Rapid neutronic shutdown, via fuel failure and molten fuel relocation, was found to occur in all cases. The parametric calculations were conducted within two categories. The first set of analysis was focused on input conditions, including variations in initial power, inlet temperature, ramp rate, reactivity bound, and various neutronic parameters. A second set of analysis was focused on phenomenological uncertainties, including fuel conditions (e.g., restructuring temperatures, fission gas retention, and transient gap conductance variations), fuel failure (e.g., variations in the Damage Parameter, axial failure location, and radial extent of melting), and fuel motion (such as axial and radial expansion, internal fuel pin molten fuel motion models, fuel/coolant interaction aspects, and fuel distribution patterns in the coolant channel. Overall, the energetics associated with both the base and parametric cases considered were found to be substantially smaller than the values for which the FFTF containment system has been evaluated. Hence, an unprotected transient overpower accident in the FFTF is believed to pose no serious threat to the safety and welfare of the public. (auth)

23927 (IRS-F-23) REPORTS ON THE RESEARCH PROJECTS IN THE FIELD OF REACTOR SAFETY SUPPORTED BY THE FEDERAL MINISTRY OF RESEARCH AND TECHNOLOGY. Period Under Review: October 1st to December 31st, 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Mar 1975. 333p. (In German). INIS.

19 figs.; 2 tabs.

The Bundesminister fuer Forschung und Technologie (BMFT) is promoting financial plans for reactor safety research. The Forschungsbetreuung at IRS (IRS-FB) as consultants to the BMFT provides information about the research planning. In addition, information is given about projects sponsored by the Bundesminister des Innern (BMI). Reports of the project "Nuclear Safety" (PNS) have been added to those concerning the projects sponsored by the BMFT or the BMI. The PNS is being conducted by the Gesellschaft fuer Kernforschung mbH (GfK), Karlsruhe. The activities during the fourth quarter of 1974 (October 1st–December 31, 1974) are reported. (auth)

23928 (IRS-W-12) LAYOUT OF NUCLEAR POWER PLANTS AGAINST EXTERNAL HAZARDS. Partial Aspect: The Risk of an Airplane Impact Upon a Nuclear Power Station (Interim Report). Suetterlin, L. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Mar 1975. 17p. (In German, English). INIS.

2 figs.; 7 refs.

The present paper has the purpose to show the risk of operating a nuclear power plant that is not protected against an airplane crash. At first, considerations of probabilities are made and numerical data for various categories of air traffic are given. A general consideration of the possible extent of damage after an airplane impact upon an unprotected nuclear power plant is followed by a discussion of the risk philosophy which is based upon the Farmer-diagrams. Furthermore the facts are specified which led to the decision that nuclear power plants in the Federal Republic of Germany must be protected against an airplane crash. (auth)

23929 (KFK-2130) NUCLEAR SAFETY PROJECT SECOND SEMIANNUAL REPORT, 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany)). May 1975. 357p. (In German). Dep. NTIS (US Sales Only) $21.00.

A description is presented of work within the Nuclear Safety Project performed in the second half of 1974 in the nuclear safety field by Gesellschaft fuer Kernforschung (GfK) institutes and departments and by external institutions on behalf of GfK. Included for each individual research activity are short summaries on work completed, essential results, and planning for the near future. (auth)

23930 (KFK-2135) MATERIALS PROBLEMS RELATED TO THE CORE CATCHER OF SODIUM COOLED REACTORS. Goetzmann, O. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). May 1975. 35p. (In German). Dep. NTIS (US Sales Only) $4.75.

There are in principal two possible solutions for the external core catcher as far as materials are concerned: (1) a barrier consisting of a material with a high melting point, or (2) a tray of comparatively low melting material with a high solubility for the fuel. In case of the first concept one has to look for materials whose melting temperatures are above the temperature of the molten core. Based on metallurgical reasons it seems very likely that the molten core does not exceed a temperature in the range between 2500 and 2800°C. Due to the compatibility situation with the molten core only a few high melting oxides will be suitable as liner materials for a core catcher. In the second case basalt or concrete, if free of water and lime, are suitable materials. Graphite is a high melting material, however, due to its behavior with the molten core it should be listed under the second group. By the reaction of graphite with the core materials the melt can be kept liquid down to temperatures of around 1100°C. The evolution of CO by this reaction should be supportable. It is an endothermal reaction. Experiments on the behavior of core catcher materials have shown that sodium is capable of penetrating into sintered bodies of UO_2 with densities of 90% TD at temperatures higher than 200°C. This may lead to the disintegration of these bodies. The exposure to moist air has not done much harm to UO_2 pellets of densities from 86 to 90% TD. Even after one year of exposure, swelling or disintegration could not be observed. Sodium is also capable of penetrating into bodies of synthetic carbon and graphite. Only well graphitized material will not be destroyed. (auth)

23931 (KFK-2148) VAPOR PRESSURE OF OXIDE FUEL UNDER HYPOTHETICAL ACCIDENT CONDITIONS (3000–5000 K). Bober, M.; Breitung, W.; Karow, H. U.; Schretzmann, K. (Kernforschungszentrum Karlsruhe (F. R. Germany)). May 1975. 12p. (In German). Dep. NTIS (US Sales Only) $4.00.

Safety analysis of fast reactors — especially the investigation of hypothetical prompt critical excursions — requires knowledge of the fuel pressures in the temperature range above 3000 K where up to now no measured data have been available. Therefore, the different short time measuring methods recently developed which are based on laser or electron beam heating of the fuel surface are compared. The principal aspects and application limits of these methods are discussed. Because of the increasingly dense plasma state of the fuel vapor, vapor pressure measurements are limited to the temperature range below about 5000 K. The vapor pressure evaluation from experimental data must be done on a gasdynamical basis. There is also the problem of exactly determining the evaporation temperature. Because of the exponential p(T)-relationship, an error in temperature determination strongly influences the reliability of the resulting vapor pressure data. The evaporation conditions in the measuring method correspond to hypothetical reactor accident conditions. The intensive evaporation compels the congruent evaporation of the fuel with a vapor composition other than that in thermodynamic equilibrium. The resulting vapor pressure therefore deviates from the saturated vapor pressure. Both vapor pressure curves — the one for thermodynamic equilibrium and that valid for forced congruent evaporation — have been calculated based on thermodynamic fuel data from the literature and are compared with the recent results of the laser evaporation experiments. (auth)

23932 (MRR-144) UNAVAILABILITY OF COLD STANDBY SYSTEMS AS A FUNCTION OF TEST STRATEGY AND REPAIR TIME. Dressler, E.; Spindler, H. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Mar 1975. 54p. (In German). Dep. NTIS (US Sales Only) $5.75.

The formulas for the unavailability of m-out-of-n cold-standby systems are derived. Such systems are installed as engineered safeguards in nuclear power plants. For simplification, each of the different lines of these systems is summed up to a substitute component. By means of the results presented it is possible to estimate the influence of various parameters on the unavailability of cold-standby systems. Especially, the influence of consecutive testing and of the repair time is discussed in detail. (auth)

23933 (NEDO-20626-2) STUDIES OF BWR DESIGNS FOR MITIGATION OF ANTICIPATED TRANSIENTS WITHOUT SCRAMS, Amendment 2. Baysinger, L. W.; Eckert, E. C.; Weis, D. G. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Jul 1975. 24p. General Electric Co., San Jose, CA.

Additional data on the radiological consequences of ATWS in BWR type reactor is presented. (JWR)

23934 (NEDO-20942) SAFETY-RELIEF VALVE DISCHARGE ANALYTICAL MODELS. Valandani, P. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). May 1975. 60p. General Electric Co., San Jose, CA.

The analytical models employed to predict the safety-relief valve transient and the pressure time-history for the pressure suppression pool due to safety-relief valve actuation are presented. (auth)

23935 (NJD-19) NERVA ACCIDENTAL CRITICALITY STUDY. (Aerojet-General Corp., Sacramento, Calif. (USA); Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Aug 1968. 130p. Dep. NTIS $9.50.

Declassified 12 Sep 1973.

A full complement of poison wires installed in the NERVA core is an effective countermeasure for preventing all potential criti-

cality accidents in all phases of operation and handling from assembly of the nuclear engine up to launch vehicle lift-off. However, in the event of a booster failure following launch, the loads imparted and possible structural damage to the reactor as a result of earth or water impact are very severe and the prevention of partial or complete displacement of the poison wires from the reactor cannot be guaranteed. It is not possible to ensure that the poison wire system will protect the reactor against inadvertent criticality under such impact conditions. Impact of the reactor on land within the vicinity of the launch pad will not introduce a significant radiological hazard. The upper limit of a nuclear excursion following land impact and compaction of an unpoisoned reactor, impacting at terminal velocity following launch booster failure, is conservatively estimated at about 60% of the energy release of the KIWI-TNT experiment. Impact of the reactor in water could lead to a water-immersion nuclear excursion conservatively estimated at about seven times the energy release of the KIWI-TNT experiment. For an ocean impact just off-shore, or water impact within a 1-mile radius of launch pad 39A, the estimated centerline downwind radiological dose at the VAB would be in the range of 2.5 rem whole-body gamma and 0.1 rem adult thyroid, well within the radiation protection guideline. Water-immersion accidents in locations other than the ocean or within about a 1-mile radius of launch pad 39A, should be avoided because of the potentially large radiation doses (greater than 10 rad whole-body gamma) at distances of less than 1 mile from the point of the excursion. There is a remote possibility of reactor criticality and subsequent oscillation or sustained power operation from a submerged reactor following ocean impact which could pose a potentially more hazardous condition than that resulting from a single destructive nuclear excursion. The feasibility of an explosive destruct system in preventing nuclear criticality has been demonstrated and could be an effective countermeasure in preventing all potential criticality accidents subsequent to launch vehicle lift-off. In most normal operations central poison wires installed in the NERVA core are an effective countermeasure to prevent criticality accidents not involving flooding of the core. (auth)

23936 (ORNL-TM-4779) THERMAL-HYDRAULIC EFFECTS OF PARTIAL BLOCKAGES IN SIMULATED LMFBR FUEL ASSEMBLIES WITH APPLICATIONS TO THE CRBR. Fontana, M. H.; Thomas, D. G.; Kress, T. S.; Wantland, J. L. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 67p. AT.

Experimental results are presented on 14-subchannel edge blockages against the duct wall in the heated zones of sodium-cooled simulated fuel assemblies tested in the Fuel Failure Mockup (FFM), and generalizations obtained from several experiments with different blockages in the FFM water mockup are presented. Estimates are made of the effects of partial blockages in the fuel, radial blanket, and control rod assemblies of the Clinch River Breeder Reactor (CRBR). Occurrence of similar blockages in CRBR is not implied. Experiments in sodium with a heated zone blockage held tightly against the duct wall and then displaced from the duct wall to allow leakage indicate that maximum local coolant temperature increases are on the order of half the temperature rise through the core and therefore do not present excessive hazards to fuel integrity. Slight leakage significantly reduces the temperature increase. Generalizations obtained from water experiments indicate that mass (and therefore heat) exchange with the flow recirculation zone behind a blockage may be correlated for various blockage sizes and shapes. Prediction of temperatures obtained in sodium experiments by use of these generalizations was reasonably successful in that temperatures were predicted within the ranges measured. Estimates of temperatures in the CRBR fuel, radial blanket, and control rod assemblies obtained by scaling water experiments indicate that fuel zone blockages as large as 3.4-in. in diameter can be tolerated. However, these estimates should be confirmed experimentally. Also, further experimental confirmation of predictions of effects in control rod and radial blanket assemblies is required because of the different rod diameters and pitch spacings utilized in these assemblies. (auth)

23937 (ORNL-TM-5005) MONTHLY HIGHLIGHTS FOR OFFICE OF NUCLEAR REGULATORY RESEARCH PROGRAMS AT OAK RIDGE NATIONAL LABORATORY. Fee, G. G. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. 38p. Dep. NTIS $5.00.

Brief highlights are presented for the following programs: heavy section steel technology; fission product beta and gamma energy release; LOCA release from LWR fuel; multirod burst tests; nuclear safety information center; PWR blowdown heat transfer; zircaloy fuel cladding collapse; zirconium metal-water oxidation kinetics; transient release from LMFBR fuel; and HTGR safety. (JWR)

23938 (REG/G-1.70.35(6-75)) INFORMATION FOR SAFETY ANALYSIS REPORTS: INTERNALLY GENERATED MISSILES. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Jun 1975. 3p. NRC.

23939 (SC-M-65-117) ANALYSIS OF THE AEROSPACE NUCLEAR SAFETY PROGRAM. (Sandia Labs., Albuquerque, N. Mex. (USA)). Apr 1965. 172p. Dep. NTIS $11.75.

The problems associated with aerospace nuclear safety are discussed and a brief review of the activities in this program is presented. The rationale which provided the basis for the Planning Committee's effort is discussed. Many facets of aerospace nuclear safety are analyzed. An overall evaluation of the program and recommendations based on the study are presented. (auth)

23940 (TID-26800) THERMAL FUELS BEHAVIOR PROGRAM MONTHLY REPORT, CRO-119-75. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Mar 1975. 28p. Dep. NTIS $4.50.

Research on fuel elements for LWR type reactors included: power-cooling missmatch accident testing; gap conductance testing; irradiation effects and simulation; LOCA testing; and reactivity-initiated accident testing. (JWR)

23941 (UCLA-ENG-6908) FORCED VIBRATION TESTS OF THE CAROLINAS–VIRGINIA TUBE REACTOR (CVTR). Report No. 69-8. Matthiesen, R. B.; Smith, C. B. (California Univ., Los Angeles (USA)). Feb 1969. 86p. Univ. of California, Los Angeles.

The CVTR containment structure underwent a series of tests conducted by Phillips Petroleum Company and Carolinas-Virginia Nuclear Power Associates under contract to the Atomic Energy Commission. These tests were part of the USAEC's power reactor safety program. While the major objective was to determine the response of the containment to a simulated loss-of-coolant accident, several tests were conducted to determine the dynamic structural properties of the containment. These include: (1) an ambient vibration survey (dynamic response of the building due to ambient vibration sources such as wind and machinery) and (2) forced vibration tests of the containment unpressurized and pressurized. The forced vibration tests are described. (auth)

23942 (WANL-TME-203) DRAFT RIFT HAZARDS SUMMARY REVIEW. Kraig, H. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Nov 1962. 112p. Dep. NTIS $8.75.

Declassified 10 Sep 1975.

The Westinghouse Astronuclear Laboratory contribution to the Reactor In Flight Test (RIFT) flight safety review is presented. The reactor and certain of its mechanical and nuclear operating characteristics are described. The reactor control system is discussed and the operating specifications for the control drum actuator are given. The nuclear poison systems for shipping, ground handling, and in-flight are described. Destruct systems including a discussion of reentry physics, chemical destruct system, nuclear destruct system, and fission product inventory are treated briefly. (auth)

23943 (WANL-TME-436) WANL CONTRIBUTION TO RIFT SAFETY REVIEW. Vachon, L. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 93p. Dep. NTIS $7.75.

Declassified 10 Sep 1973.

Various features have been incorporated in the NERVA reactor design to ensure a safe and successful RIFT test. For example, mechanical design is based on the environmental loads which the reactor may encounter during shipping and ground handling, as well as during launch and flight. The small shutdown margin in the control system is protected by a number of devices including a control drum spring that tends to maintain the drum in the least reactive position, and a mechanical lock on the control drums as a protection against inadvertent rotation during handling and shipping. A screen has been located in the reactor assembly to filter any particles in the coolant stream that could obstruct the fuel channels. However, the most effective method by which safety has been incorporated in the RIFT program is the extensive KIWI-NRX testing program to verify the reliability and design of the NERVA reactor as well as identify any special safety problems tha may be inherent in the system. The reactor is described in detail; its nuclear and thermal characteristics are given; and anticriticality safety systems, post-operational destruct systems and reentry safety studies are discussed. (auth)

23944 (WANL-TME-521) DRAFT CONTRIBUTIONS TO NRX SAFETY ANALYSIS REPORT. Vachon, L. J.; Cleary, J. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 215p. Dep. NTIS $13.75.

Declassified 11 Sep 1973.

Factors related to safety and reactor safety are described: management organization and responsibility, site topography, meteorology, test facilities, gas storage and cryogenic facilities, reactor control systems, reactor design, etc. Some items are discussed in more detail: hot channel factor in the reactor (hottest fuel channel temperature due to manufacturing variations), precautions with liquid hydrogen, reactor shutdown and cooldown procedures, etc. (LTN)

23945 (WANL-TME-761(Suppl.1-6)) SUPPLEMENT TO NRX-A2 SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Oct 1964. 272p. Dep. NTIS $16.75.

Additional tests now planned to be performed on the NRX-A2 reactor are justified and analyzed with respect to personnel and reactor safety. (LTN)

23946 (WANL-TME-761(Suppl.5)) SUPPLEMENT TO NRX-A2 SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Sep 1964. 34p. Dep. NTIS $4.75.

Declassified 10 Jul 1975.

A revised profile for the NRX-A2 power run provides for a 60 second hold at 56% of full power followed by operation at 85% of full power for a period in the order of 8-10 minutes. The run time will be selected as the maximum consistent with the coolant inventory at the time of the test to insure that adequate coolant is available to complete the run and for shutdown and cooldown of the reactor. Gaseous hydrogen required for turbine operation and cooldown will probably be the limiting item. The nominal integrated power for the run will be 6×10^5 MW-Sec. Following the first run, a restart of the reactor is planned. The actual run profile for the second run will be established after completion of the initial run. During the shutdown period the Test Director and the Data Review Team review will be the basis for restart and for recommending the specific test conditions and profile for the second run. The second run will be performed in accordance with the approval granted by the Test Review Board. One of the objectives of the second run is to operate the reactor at full power for a brief time—up to one minute. For the purposes of fission product release a power run equivalent to that discussed in the SAR (3.45×10^5 MW-Sec at full power) was considered. The time period between the two runs will be about 1-2 weeks. (auth)

23947 (WANL-TME-761(Suppl.6)) SUPPLEMENT TO NRX-A2 SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Oct 1964. 19p. Dep. NTIS $4.00.

Declassified 16 Jul 1975.

An additional test has been proposed for the NRX-A2 to demonstrate startup and steady-state operation and to explore the behavior of the NRX-A reactor system in the low-power, low-flow regime. Verification of predicted behavior and analysis techniques in this region is essential for effective and timely planning of NRX/EST and NERVA engine testing. Performance of such a test with NRX-A2 is considered necessary to allow exploration of anomalies if they should exist and for extension of the performance area mapped in NRX-A3 and A4. In addition, operation under flow control conditions is considered to be valuable in planning reactor shutdown cooling on LH_2. The specific objectives are: (1) To verify the capability of the reactor system to operate stably and in accordance with predictions in the low-power, low-flow (low nozzle inlet pressure) region of the steady-state operation map under power control. (2) To verify the power response of the reactor system to changes in LH_2 flow (and density) with constant drum position and (3) To verify the ability of test cell A to provide stable LH_2 flow under dewar pressure driving head. Operating limits are specified and possible hazards are evaluated. (auth)

23948 (WANL-TME-775) LIQUID HYDROGEN FLOW DECAY FROM TEST CELL "A" FEEDSYSTEM TO REACTOR OR ORIFICE FLOW IMPEDANCE. Rovnak, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 May 1964. 9p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Information is presented for possible future use as an analytical aid in the preliminary development of a proposed propellant-nozzle-inlet-pressure control loop for safeguarding the reactor in event of a loss-of-liquid flow to the mixing chamber during reactor power tests. (auth)

23949 (WANL-TME-1061(Rev. 1)) REVIEW OF NUCLEAR SAFEGUARDS FOR NRX REACTORS DURING PRE-TEST ASSEMBLY OPERATIONS AT NRDS. Safety Evaluation Report, Part I. Hemmerle, E. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1967. 77p. Dep. NTIS $7.00.

The purpose of Part 1 of the Safety Evaluation Report (SER) is to summarize the safeguards which will prevent accidental criticality during operations with NRX reactors at NRDS prior to initial criticality. These operations include receipt of the reactor, inspection, assembly of the test assembly, transport to Test Cell "C," and checkout at Test Cell "C" prior to initial criticality. The potential mechanisms which could lead to an accidental criticality of an NRX reactor in the MAD assembly area or at the test cell prior to initial criticality were identified: Accidental insertion of moderation (particularly hydrogenous material) after the shipping poison wire system was removed, loss of shutdown margin through excess reflection, accidental rotation of control drums during periods when auxiliary poison is not used and loss of shutdown margin during removal of the auxiliary poison. The safeguards against these potential problems are outlined: Accidental rotation of multiple control drums (which would be required for criticality) is prevented primarily thru locks on the control drum actuators; the auxiliary poison used during core shipment is removed in a safe and pre-planned manner accompanied by neutron source multiplication measurements which establishes that a safe reactivity shutdown margin exists; the reactor assembly is protected against the introduction of extraneous material after the shipping poison wires are removed by performing the work on the reactor in a controlled area and/or use of a cover to close the nozzle end opening of the reactor pressure vessel; and the movement of the reactor, auxiliary equipment personnel or additional reactors that may be in the MAD Building in the vicinity of the reactor is limited by controls established through the Criticality Control Manual. (auth)

23950 (WANL-TME-1126(Suppl.4)) NRX/EST SAFETY EVALUATION REPORT. Skaritka, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Feb 1966. 19p. Dep. NTIS $4.00.

This supplement to the NRX-A4-EST Safety Evaluation review was prepared as a safety review of the planned full power tests (EP III and EP IV). It consists basically of the results of malfunction analysis applicable to full power operation. The effects of most of the considered malfunctions and the system response have been calculated with the CAM-II-C analog computer model. (LTN)

23951 (WANL-TME-1431) EVALUATION OF THE THERMAL RESPONSE OF THREE PROPOSED REACTOR DESIGNS TO POST-OPERATIONAL HEATING CONDITIONS. Trammell, M. R.; McCune, W. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jun 1966. 175p. Dep. NTIS $11.75.

Declassified 10 Sep 1973.

Analyses of the radiological consequences attendant on the possible failure of a nuclear rocket engine during an assigned mission have indicated that, for a variety of reasons, it is desirable that the reactor engine be maintained in an intact configuration for an extended period of time following such a failure. A resume of the reasons leading to this conclusion is given. The major components which determine whether or not a reactor core can be maintained in an intact configuration are those which comprise the lateral support system. In the Be-Ring and Graphite Barrel designs, the component which contributes lateral support and is subject to high temperature failure is the beryllium reflector; in the PHOEBUS-II design, it is the inner aluminum reflector. Therefore, an estimate of the effective lifetime of the lateral support system can be obtained from an examination of the temperature histories of these components in each design. Extrapolation of WANL Materials Manual data on the yield and ultimate tensile strength of beryllium as a function of temperature indicates that the beryllium reflector structure may have a tensile capability of ~1000 psi up to 1960°R and of ~500 psi up to 2250°R. An estimate of the bundling force in the reflector due to the core lateral support system in two of the designs is ~400-500 psi. Therefore, a measure of the effective lifetime of the lateral support system at all axial locations within the beryllium reflector in the Be-Ring and Graphite Barrel designs can be taken as the length of time after loss of coolant required for its temperature at that location to reach 2250°R. Lateral support forces in the PHOEBUS-II aluminum reflector can be maintained only so long as the integrity of the aluminum barrel persists. Since no estimate of the bundling force in the reflector is available, an upper limit on its effective lifetime can be obtained by measuring the length of time after loss of coolant required for its temperature at any axial location to reach 1260°R, at which time the material capability is ~0 psi. (auth)

23952 (WANL-TNR-099(Rev. A)) SAFETY REPORT FOR THE ASTRONUCLEAR WESTINGHOUSE EXPERIMENTAL

FACILITY (PAX AND FCX). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1967. 186p. Dep. NTIS $12.50.

Declassified 10 Sep 1973.

The design features of the PAX and FCX assemblies and the administrative controls and engineered safeguards that have been incorporated in the WANEF operating procedures are considered to be most adequate in preventing a criticality accident in the course of the NERVA experimental program. The consequences of those accidents which have been judged to be credible fall within the limitations imposed by control vane melting and the threshold for fission product diffusion. Operation of the PAX reactor within the contraints specified in this safety and analysis can therefore be accomplished without undue risk to either operating personnel or the general public. (auth)

23953 (WANL-TNR-206) PROGRAM REPORT ON THE ANTICRITICALITY POISON WIRE SYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Feb 1966. 48p. Dep. NTIS $10.50.

Declassified 12 Sep 1973.

The status of the development program for the Anti-Criticality Poison Wire System (ACPS) is documented. The need for an in-flight poison wire system for maintaining the NERVA reactor sub-critical from assembly to operation in space was realized early in the NERVA program. At the present time, a shipping type of poison wire is in use. However, its use for space operation is limited due to material rigidity, excessive weight and neutronic values. It was therefore necessary to develop a flexible poison wire capable of being extracted from the reactor core through the nozzle throat for system storage or ejection. The system design is based on criteria derived from normal and accidental environmental conditions which might conceivably be encountered during assembly and space flight. In addition to listing the criteria upon which the ACPS system is based, a description of the entire system, operational sequences, and control features is provided. Reliability has been stressed and is reflected in the conceptual design of each component. Problems of hardware availability, manufacturing technique, and material selection have been substantially resolved. Fabrication and successful testing of key sections of the ACPS have been accomplished. (auth)

23954 (WCAP-7862-A) ISOLATION TESTS PROCESS INSTRUMENTATION ISOLATION AMPLIFIER WESTINGHOUSE COMPUTER AND INSTRUMENTATION DIVISION NUCANA 7300 SERIES. Garber, I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Mar 1975. 17p. Westinghouse Electric Corp., Pittsburgh.

Four groups of isolator cards, namely, Style Nos. 2837A10G04, 2837A10G06, 2837A12G02, and 2837A12G03 are manufactured by Westinghouse Computer and Instrumentation Division. Style Nos. 2837A10G04, 2837A12G02, and 2837A12G03 were tested at normal ambient temperature for isolation characteristics. The Style No. 2837A10G06 isolator output stage is identical to that of Style No. 2837A10G04. The difference between these two cards is in the number of signal input converters. The -G04 has one input converter and the -G06 has four input converters. The isolator assemblies tested maintained input circuit integrity (protection circuit) for all disturbances applied to the common mode and normal mode of the output circuit. In some cases, the output stage was damaged by the applied disturbance, but the protection circuit remained functional and within design accuracy limits. Although Style No. 2837A10G06 was not tested, the test results obtained for Style No. 2837A10G04 are applicable to Style No. 2837A10G06 based on the fact that the damage occurred only in the output stage. (auth)

23955 BASIC ISSUE OF THE LIQUID METAL BREEDER REACTOR: SAFETY AND THE ENVIRONMENT. Taylor, J. J. pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc, (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

LMFBR safety and environmental impact are discussed in the context of comparing the safety risks inherent in developing and utilizing the LMFBR with the economic risks of failure to develop an adequate energy supply. Emphasis is placed on the extensive efforts toward safety assessment of the breeder program. Operational safety considerations are discussed together with safety under accident conditions. (DG)

23956 EMERGENCY COOLING SYSTEM FOR A NUCLEAR REACTOR INSTALLATION. (to Stichting Reactor Centrum Nederland). Netherlands Patent 7,400,614/A/. 17 Jan 1974. 15p. (In Dutch).

The invention incorporates a nuclear power installation using at least one emergency cooling system for the removal of decay heat and whereby the primary cooling circuit has one or more vapor-liquid thermosyphon circuits, wherein at least one heat exchanger is present. This is especially important for ship reactors as it causes a minimum of coolant material to be above the meta-centre of the ship thus improving stability. (NL)

23957 BLOWDOWN ANALYSIS IN PWR. Cha, J. H. J. Korean Soc. Mech. Eng.; 14: No. 1, 63-72(1974). (In Korean).

A PWR blowdown analysis is presented for the postulated loss-of-coolant accident as a part of nuclear reactor safety analysis program. Most of the analysis is performed by means of RELAP -3 Code, and the calculations are presented to show such blowdown behavior as depressurization and variations of coolant flowrate and fuel temperature transients as a function ot time during double ended cold leg 4.0 sq. ft. break accidents in the 1728MW thermal output, 2 loop, PWR. The computational models were formulated in the three-volume model and the eight-volume model by dividing the volume of primary coolant system. The following significant results were obtained: (1) a longer period of blowdown results from the eight volume model compared with the three volume model because of the considerable flow resistance in piping; (2) the maximum cladding temperature is 1840°F and appeared at 8 sec. after break for the case of peaking factor of 2.6 during blowdown. (Korean Sci. Abstr.)

23958 HIGH TEMPERATURE REACTOR INSTALLATIONS. George, B. V.; Cairns, W. J.; Cook, R. K. (to British Nuclear Design and Construction Ltd.). British Patent 1,386,962/B/. 12 Mar 1975. Filed Date 2 Feb 1972. 15p.

Reference is made to pressure vessel arrangements for high temperature reactor installations. The object of the arrangement described is to provide a pressure vessel system that reduces the risk of dangerous rapid depressurization of the reactor coolant. (UK)

23959 SAFETY OF NUCLEAR POWER STATIONS IN CANADA. Laurence, G. C. B. C. Prof. Eng.; 26: No. 3, 27-29(Mar 1975).

The logical inconsistencies of the nuclear safety controversy are discussed. Common fallacies about radiation hazards are discussed. The properties of the radionuclides that can escape from a nuclear power station are explained. Exposure limits and attendant risks to the population at large merit discussion as does reactor safety design and accident probability analysis. The advantageous aspects of the Canadian nuclear safety program are explained. (CA)

23960 PROBLEMS OF ENVIRONMENTAL PROTECTION DURING ATOMIC POWER STATION OPERATION. Gusev, N. G. At. Energ. (USSR); 38: No. 6, 391-397(Jun 1975). (In Russian).

As a result of atomic power development and the appearance of new sources of ionizing radiation, the question of the need for partial distribution of the dose limit from these sources is raised. A percentage distribution of dose limit from fifteen basic radiation sources is proposed. Such sources, playing an important role in human activity, are: reactors of various types, nuclear fuel reprocessing plants, building materials and agricultural fertilizers of increased natural radioactivity content, television etc. The estimation of population dose from all sources of radiation is considered necessary. A new model for calculating population dose is described briefly. A review of other investigations devoted to the above questions is given. (1 figures, 3 tables, 31 references) (auth)

23961 CHARACTERIZATION OF NUCLEAR SITES. Zambrini, R. Com. Naz. Energ. Nucl., Not.; 21: No. 3, 105-108(Mar 1975). (In Italian).

A discussion is presented of the substantial elements of the siting problem including formulation of a basic criterion of a probabilistic nature as a standard for evaluation and as an instrument for land-planning research. (auth)

23962 PRELIMINARY REMARKS ON EMERGENCY COOLING OF LWR. Cumo, M.; Farello, G. E.; Palazzi, G. (CNEN, Rome). Termotecnica (Milan); 29: No. 1, 17-26(Jan 1975).

From 28th national ATI meeting; Turin, Italy (Sep 1973).

Fundamental aspects of the emergency cooling of LWR cores after the loss of coolant accident have been studied in the case of reflooding. A simplified experimental situation has been realized with uniform and constant power injected in a tubular test section, visualized at the outlet. From more than 150 cooling curves a set of representative diagrams have been deduced among the main parameters as "turnaround" temperatures and times, "rewetting" temperatures and times, etc. Physical heat transfer models have been supposed, also with the aid of the visualization techniques employed, expressing them in digital codes and comparing the results with the experimental data. (auth)

23963 EXPERIMENTAL STUDIES ON SODIUM FIRES. Application to Reactors. Fruchard, Y.; Cercy, J.; Colome, J.;

Malet, J. C. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. de Surete Nucleaire); Duco, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Surete Nucleaire). pp 196-198 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The experimental program developed at the Cadarache Center by the Department of Nuclear Safety is described. The most important part of the program relates to pool fires occurring in tight or poorly ventilated vessels. The purpose is to simulate sodium leakage resulting from pipe rupture in the secondary cooling system. The program has two parts: Cassandre for pool fires at 550°C and Lucifer for pool fires of 300 kg over $2m^2$. (FR)

23964 SIMPLIFIED SMALL-BREAK BLOWDOWN MODELS. Ward, L. W. (Combustion Engineering, Inc., Windsor, CT). Nucl. Technol.; 26: No. 3, 247-253(Jul 1975).

The behavior of the primary system coolant in a pressurized water reactor during a small-break loss-of-coolant accident (LOCA) is governed by the hydrostatic forces that develop in the system. Digital simulation of the hydrostatic interactions during a small-break LOCA can be achieved with simplified nodal representations that significantly reduce computer times. The simplification process can be successfully achieved by combining primary system regions that behave symmetrically while preserving the basic manometer or U-tube design of the system. The simplified nodal representations have the capability of assessing the hydrostatic effects on the blowdown for the spectrum of small breaks wherein detailed model computations become economically prohibitive for parametric analyses of emergency core cooling systems. (auth)

23965 ENVIRONMENTAL IMPACT ON BREEDER REACTORS FOR POWER GENERATION. Cope, D. F. (Atomic Energy Commission, Oak Ridge, TN). pp 345-358 of Air Pollution Control and Industrial Energy Production. Noll, K. E. (ed.). Ann Arbor, MI; Ann Arbor Science Publishers Inc. (1975).

The characteristics of the LMFBR are reviewed and compared to those of typical light water reactors. Those features of the LMFBR are examined which are important in environmental and safety considerations, and expected impacts on air quality, water quality and solid wastes are discussed. (DG)

23966 RADIOACTIVE WASTE WATERS FROM NUCLEAR POWER STATIONS IN THE FEDERAL REPUBLIC OF GERMANY FOR 1974. Wolter, R.; Arndt, J. (Bundesgesundheitsamt, Berlin (F. R. Germany). Inst. fuer Wasser-, Boden- und Lufthygiene). Bundesgesundheitsblatt.; 18: No. 7, 113-115(Apr 1975). (In German).

The radioactive waste waters released in 1974 from nuclear power stations in the Federal Republic of Germany were analysed for specific radionuclides. The results are given as a table. (GE)

Reactor Theory and Calculation

23967 (ANL-75-2) PROCEEDINGS OF THE NEACRP MEETING OF A MONTE CARLO STUDY GROUP, JULY 1-3, 1974, ARGONNE, ILLINOIS. Hytry, C. (comp.). (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-eng-38. 341p. (CONF-740710-; NEACRP-L-118). Dep. NTIS $10.60.

Separate abstracts are included for each of the 17 papers presented concerning the use of Monte Carlo techniques in reactor physics studies. (DCC)

For abstracts of individual papers see: 23968–23983, and 23989.

23968 (ANL-75-2, pp 5-22) EFFICIENT DATA MANAGEMENT TECHNIQUES IMPLEMENTED IN THE KARLSRUHE MONTE CARLO CODE KAMCCO. Arnecke, G.; Borgwaldt, H.; Brandl, V.; Lalovic, M. (Kernforschungszentrum, Karlsruhe, Ger.). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The Karlsruhe Monte Carlo Code KAMCCO is a forward neutron transport code with an eigenfunction and a fixed source option, including time-dependence. A continuous energy model is combined with a detailed representation of neutron cross sections, based on linear interpolation, Breit-Wigner resonances and probability tables. All input is processed into densely packed, dynamically addressed parameter fields and networks of pointers (addresses). Estimation routines are decoupled from random walk and analyze a storage region with sample records. This technique leads to fast execution with moderate storage requirements and without any I/O-operations except in the input and output stages. 7 references. (auth)

23969 (ANL-75-2, pp 23-52) GENERAL MONTE CARLO CODE MONK. Moore, J. G. (UKAEA, Culcheth, Eng.). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The Monte Carlo code MONK is a general program written to provide a high degree of flexibility to the user. MONK is distinguished by its detailed representation of nuclear data in point form i.e., the cross-section is tabulated at specific energies instead of the more usual group representation. The nuclear data are unadjusted in the point form but recently the code has been modified to accept adjusted group data as used in fast and thermal reactor applications. The various geometrical handling capabilities and importance sampling techniques are described. In addition to the nuclear data aspects, the following features are also described; geometrical handling routines, tracking cycles, neutron source and output facilities. 12 references. (auth)

23970 (ANL-75-2, pp 53-66) MONTE CARLO CODE DEVELOPMENT IN LOS ALAMOS. Carter, L. L.; Cashwell, E. D.; Everett, C. J.; Forest, C. A.; Schrandt, R. G.; Taylor, W. M.; Thompson, W. L.; Turner, G. D. (Los Alamos Scientific Lab., NM). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The present status of Monte Carlo code development at Los Alamos Scientific Laboratory is discussed. A brief summary is given of several of the most important neutron, photon, and electron transport codes. 17 references. (auth)

23971 (ANL-75-2, pp 69-74) DISCRETE APPROACH TO COMPLEX PLANAR GEOMETRIES. Cupini, E.; De Matteis, A. (Comitato Nazionale Energia Nucleare, Bologna). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

Planar regions in Monte Carlo transport problems have been represented by a finite set of points with a corresponding region index for each. The simulation of particle free-flight reduces then to the simple operations necessary for scanning appropriate grid points to determine whether a region other than the starting one is encountered. When the complexity of the geometry is restricted to only some regions of the assembly examined, a mixed discrete-continuous philosophy may be adopted. By this approach, the lattice of a thermal reactor has been treated, discretizing only the central regions of the cell containing the fuel rods. Excellent agreement with experimental results has been obtained in the computation of cell parameters in the energy range from fission to thermalization through the ^{238}U resonance region. (auth)

23972 (ANL-75-2, pp 75-93) ORGANIZATION OF CROSS-SECTION DATA IN THE MONTE CARLO CODE SPARTAN. Bending, R. C. (Central Electricity Generating Board, Berkeley, Eng.). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The Monte Carlo code SPARTAN is a general-purpose code intended for neutron or gamma transport calculations. The code is designed to accept physics data from a number of external libraries (which may be used singly or in combination) and to use this data with as little alteration as possible. Data obtained from one or several libraries is placed in an interface file on magnetic tape or disk, using a general hierarchical structure which allows particular data items to be assessed in a straightforward way. The interface file, with or without additional data from cards, is regarded as a data source for the main Monte Carlo calculation. A summary of the functional forms, sampling distributions, and particle interaction laws which are available at present, and some of the mathematical methods used are described. 5 references. (auth)

23973 (ANL-75-2, pp 95-118) GEOMETRY SYSTEM USED IN THE GENERAL MONTE CARLO TRANSPORT CODE SPAR-

TAN. Bending, R. C.; Easter, P. G. (Central Electricity Generating Board, Berkeley, Eng.). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The geometry routines used in the general-purpose, three-dimensional particle transport code SPARTAN are described. The code is designed to deal with the very complex geometries encountered in lattice cell and fuel handling calculations, health physics, and shielding problems. Regions of the system being studied may be represented by simple shapes (spheres, cylinders, and so on) or by multinomial surfaces of any order, and many simple shapes may be combined to make up a complex layout. The geometry routines are designed to allow the program to carry out a number of tasks (such as sampling for a random point or tracking a path through several regions) in any order, so that the use of the routines is not restricted to a particular tracking or scoring method. Routines for reading, checking, and printing the data are included. (auth)

23974 (ANL-75-2, pp 119-130) RANDOM NUMBER GENERATION. Coveyou, R. R. (Union Carbide Corp., Oak Ridge, TN). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The subject of random number generation is currently controversial. Differing opinions on this subject seem to stem from implicit or explicit differences in philosophy; in particular, from differing ideas concerning the role of probability in the real world of physical processes, electronic computers, and Monte Carlo calculations. An attempt is made here to reconcile these views. The role of stochastic ideas in mathematical models is discussed. In illustration of these ideas, a mathematical model of the use of random number generators in Monte Carlo calculations is constructed. This model is used to set up criteria for the comparison and evaluation of random number generators. (auth)

23975 (ANL-75-2, pp 133-147) BELL TRANSFORM. Everett, C. J.; Cashwell, E. D. (Los Alamos Scientific Lab., NM). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

An exposition and extension is given of some work of M. Bell at CERN, involving the construction of a radially symmetric probability density in the plane which has a given marginal density. The problem is of importance in certain Monte Carlo procedures. While our results are more extensive and precise, the crucial step relies on a remarkable integral transform discovered by Bell. (auth)

23976 (ANL-75-2, pp 149-159) COARSE-MESH REBALANCING ACCELERATION FOR EIGENVALUE PROBLEMS. Asaoka, T.; Nakahara, Y.; Miyasaka, S. (Japan Atomic Energy Research Inst., Tokai, Japan). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The coarse-mesh rebalance method is adopted for Monte Carlo schemes for aiming at accelerating the convergence of a source iteration process. At every completion of the Monte Carlo game for one batch of neutron histories, the scaling factor for the neutron flux is calculated to achieve the neutron balance in each coarse-mesh zone into which the total system is divided. This rebalance factor is multiplied to the weight of each fission source neutron in the coarse-mesh zone for playing the next Monte Carlo game. The numerical examples have shown that the coarse-mesh rebalance Monte Carlo calculation gives a good estimate of the eigenvalue already after several batches with a negligible extra computer time compared to the standard Monte Carlo. 5 references. (auth)

23977 (ANL-75-2, pp 161-199) MONTE CARLO EIGENFUNCTION STRATEGIES AND UNCERTAINTIES. Gast, R. C.; Candelore, N. R. (Bettis Atomic Power Lab., West Mifflin, PA). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

Comparisons of convergence rates for several possible eigenfunction source strategies led to the selection of the "straight" analog of the analytic power method as the source strategy for Monte Carlo eigenfunction calculations. To insure a fair game strategy, the number of histories per iteration increases with increasing iteration number. The estimate of eigenfunction uncertainty is obtained from a modification of a proposal by D. B. MacMillan and involves only estimates of the usual purely statistical component of uncertainty and a serial correlation coefficient of lag one. 14 references. (auth)

23978 (ANL-75-2, pp 201-240) MONTE CARLO WORK AT ARGONNE NATIONAL LABORATORY. Gelbard, E. M.; Prael, R. E. 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

A simple model of the Monte Carlo process is described and a (nonlinear) recursion relation between fission sources in successive generations is developed. From the linearized form of these recursion relations, it is possible to derive expressions for the mean square coefficients of error modes in the iterates and for correlation coefficients between fluctuations in successive generations. First-order nonlinear terms in the recursion relation are analyzed. From these nonlinear terms an expression for the bias in the eigenvalue estimator is derived, and prescriptions for measuring the bias are formulated. Plans for the development of the VIM code are reviewed, and the proposed treatment of small sample perturbations in VIM is described. 6 references. (auth)

23979 (ANL-75-2, pp 243-260) FOCUS: A NON-MULTIGROUP ADJOINT MONTE CARLO CODE WITH IMPROVED VARIANCE REDUCTION. Hoogenboom, J. E. (Delft Technological Univ., The Netherlands). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

A description is given of the selection mechanism in the adjoint Monte Carlo code FOCUS in which the energy is treated as a continuous variable. The method of Kalos who introduced the idea of adjoint cross sections is followed to derive a sampling scheme for the adjoint equation solved in FOCUS which is in most aspects analogous to the normal Monte Carlo game. The disadvantages of the use of these adjoint cross sections are removed to some extent by introduction of a new definition for the adjoint cross sections resulting in appreciable variance reduction. At the cost of introducing a weight factor slightly different from unity, the direction and energy are selected in a simple way without the need of two-dimensional probability tables. Finally the handling of geometry and cross section in FOCUS is briefly discussed. 6 references. (auth)

23980 (ANL-75-2, pp 261-279) MONTE CARLO TECHNIQUE FOR LOCAL PERTURBATIONS IN MULTIPLYING SYSTEMS. Bernnat, W. (Univ., Stuttgart). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The use of the Monte Carlo method for the calculation of reactivity perturbations in multiplying systems due to changes in geometry or composition requires a correlated sampling technique to make such calculations economical or in the case of very small perturbations even feasible. The technique discussed here is suitable for local perturbations. Very small perturbation regions will be treated by an adjoint mode. The perturbation of the source distribution due to the changed system and its reaction on the reactivity worth or other values of interest is taken into account by a fission matrix method. The formulation of the method and its application are discussed. 10 references. (auth)

23981 (ANL-75-2, pp 281-292) BOUNDED ESTIMATION OF FLUX-AT-A-POINT FOR ONE OR MORE DETECTORS. Steinberg, H. A. (Mathematical Applications Group, Inc., Elmsford, NY). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

The procedure for biasing the collision density of Monte Carlo particles, so that the estimation of flux at a point detector is bounded, is described. The theory and program design of the solution of the problem of obtaining estimates for several detectors during a single Monte Carlo calculation is presented. 4 references. (auth)

23982 (ANL-75-2, pp 295-313) DIRECTION-DEPENDENT EXPONENTIAL BIASSING. Bending, R. C. (Central Electricity Generating Board, Berkeley, Eng.). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

When Monte Carlo methods are applied to penetration problems, the use of variance reduction techniques is essential if realistic computing times are to be achieved. A technique known as direction-dependent exponential biassing is described which is simple to apply and therefore suitable for problems with difficult geometry. The material cross section in any region is multiplied by a factor which depends on the particle direction, so that particles travelling in a preferred direction "see" a smaller cross section than those travelling in the opposite direction. A theoretical study shows that substantial gains may be obtained, and that the choice of biassing parameter is not critical. The method has been implemented alongside other importance sampling techniques in the general Monte Carlo code SPARTAN, and results obtained for simple problems using this code are included. 4 references. (auth)

23983 (ANL-75-2, pp 339-349) MCT: A MONTE CARLO CODE FOR TIME-DEPENDENT NEUTRON THERMALIZATION PROBLEMS. Cupini, E.; Simonini, R. (Comitato Nazionale Energia Nucleare, Bologna). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

In the Monte Carlo simulation of pulse source experiments, the neutron energy spectrum, spatial distribution and total density may be required for a long time after the pulse. If the assemblies are very small, as often occurs in the cases of interest, sophisticated Monte Carlo techniques must be applied which force neutrons to remain in the system during the time interval investigated. In the MCT code a splitting technique has been applied to neutrons exceeding assigned target times, and we have found that this technique compares very favorably with more usual ones, such as the expected leakage probability, giving large gains in computational time and variance. As an example, satisfactory asymptotic thermal spectra with a neutron attenuation of 10^{-5} were quickly obtained. (auth)

23984 (GKSS-75/E/2) CHECK OF THE ACCURACY OF THE HEAT-RESISTANCE APPROXIMATION IN UO_2 FUEL ROD DYNAMIC BEHAVIOR. Fiebig, R. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Inst. fuer Physik). 1975. 6p. (In German). INIS.

18 figs.; 7 refs. Special print from Atomkernenergie v. 24(2), 1974, p. 105-110. Available from ZAED.

The heat resistance approximation used for description of a fuel rod in a water reactor core is checked by calculations with the program TOODEE. It is shown that use of a quasistationary approximation is sufficient for time dependent realistic reactor excursions. But non-linearities in heat capacity and heat conductivity of UO_2 cannot be neglected if accuracy less than 10% is attempted. (auth)

23985 MECHANISM OF FORMATION OF RADIOACTIVE AEROSOLS IN THE HORIZONTAL CHANNELS OF A NUCLEAR REACTOR. Eliseev, L. A.; Katamadze, N. M. (Inst. of Physics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 77: No. 1, 57-60(Jan 1975). (In Russian).

The mechanism of formation of radioactive aerosols in the horizontal channels of a nuclear reactor has been investigated. It is shown that the main mechanism is the activation of non-radioactive aerosols existing in the air. ^{24}Na, ^{51}Cr, ^{60}Co, ^{82}Br, and ^{203}Pb were found to be present among the identified radioactive isotopes. (auth)

23986 EXCITATION OF ACOUSTIC OSCILLATIONS IN A NUCLEAR REACTOR WITH A CIRCULATING GASEOUS FUEL. Denisov, V. A. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1186-1189(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 426-428(Nov. 1974).

An analytical investigation is made using perturbation theory, and the conditions for stability against acoustic oscillations are identified. (DG)

23987 NUCLEAR REACTOR AS A SOURCE OF LOW-TEMPERATURE PLASMA FOR MHD CONVERTERS. Safin, Yu. A.; Moskovkin, V. N. (Ural Science Center, Sverdlovsk, USSR). Magnitogidrodin. Metod Preobraz. Energ.; No. 1, 149-152(1972). (In Russian).

An examination is made of the idea of increasing the electric conductivity of plasma in a closed MHD installation with nuclear reactor by means of auxiliary ionization. It is proposed that non-equilibrium plasma ionization (in the temperature range of 1500-2200 K) be achieved by introducing into the gas heat transfer agent either nuclear additives or a fissionable isotope. In the case where the additives used are $_2He^3$, $_3Li^6$, $_5B^{10}$, nuclear reactions with emission of charged particles occur of the (n,p), (n,α) type, and since the reactions are exothermal there is not only strong ionization, but also heating of the flow of heat-transfer agent. An estimate is made of the conductivity of a helium plasma with a "nuclear" ionizing additive of isotope $_2He^3$ (collision cross section ~5400 δ). By transforming the known relations for conductivity σ, a formula was found for calculating the σ of a mixture (50% $_2He^4$ + 50% $_2He^3$) which takes the form $\sigma_{mix} = 9 \cdot 10^7 \times n_e/\sqrt{T_e}n$ (where the symbols have the conventional meaning). At T = 1500 K and P = 0.485 MN/m^2, assuming a recombination coefficient of 10^{-11} cm^3/s and a thermal neutron flux of 10^{15} neutrons/cm^2 · s it was found that σ_{mix} = 25 Ω/m. It is noted that the σ of the heat-transfer agent can be appreciably increased by introducing a fissionable material such as uranium hexafluoride (UF_6) into its channel. It is emphasized that when a cavity reactor is used in an arrangement with an MHD generator with UF_6 as the working fluid and heat transfer agent, a high upper temperature can be successfully combined with a relatively low uranium ionization potential (~6 eV). As a result, both the efficiency of the cycle and the conductivity of the plasma are increased. It is noted that in spite of the experience already accumulated in the use of cavity reactors, checking out methods of calculating them in closed systems with MHD generator necessitates experimental studies of the hydrodynamics, heat transfer and neutron characteristics of such systems. (JPRS)

23988 THEORY OF THE CYLINDRICAL MULTIZONE REACTOR WITH FUEL ELEMENTS. Schuerrer, F. (Inst. fuer Theoretische Physik und Reaktorphysik, Graz). Acta Phys. Austr.; 38: No. 3, 272-281(1973). (In German).

Spherical pile reactors have been extensively studied in Germany. Recently the use of spherical fuel elements in liquid-cooled reactors has been proposed. The advantages of sphere piling could therefore be combined with the experiences gained in the operation of water-cooled reactors. The model for this type of reactor was introduced and the necessary formulas for the calculation of the neutron flux distribution and the effective multiplication factor in the double ring core were derived in the framework of a one-group theory. The flux distribution was numerically calculated in order to establish a valid core geometry. (tr-auth)

Reactor Components and Accessories

Refer also to abstracts 22193, 22250, 22810, 22817, 22843, and 22844.

23989 (ANL-75-2, pp 315-338) MONTE CARLO METHODS FOR SHIELD DESIGN CALCULATIONS. Grimstone, M. J. (UKAEA, Winfrith, Eng.). 1974.

From Monte Carlo conference; Argonne, Illinois, USA (1 Jul 1974).

In proceedings of the NEACRP meeting of a Monte Carlo study group. (Argonne National Lab., Ill. (USA)).

A suite of Monte Carlo codes is being developed for use on a routine basis in commercial reactor shield design. The methods adopted for this purpose include the modular construction of codes, simplified geometries, automatic variance reduction techniques, continuous energy treatment of cross section data, and albedo methods for streaming. Descriptions are given of the implementation of these methods and of their use in practical calculations. 26 references. (auth)

23990 (MRR-138) RELIABILITY ANALYSIS AS A METHOD OF OBJECTIVIZING THE EVALUATION OF TECHNICAL SYSTEMS. Basti, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Jun 1974. 25p. (In German). Dep. NTIS (US Sales Only) $4.25.

Starting from general considerations concerning the application of the reliability analysis to electronic systems some basic difficulties are discussed when using it for investigation of nuclear reactors. The constraints of a statistical approach based upon few data is shown by a simple example. Some problems are highlighted which appear in the context with common mode failures and with the as-good-as-new hypothesis. Emphasis is laid upon the necessity for an appropriate implementation of the accident dynamics in the reliability analysis. (auth)

23991 (ZJE-160) INTERACTION OF STRAIN AND RADIATION DAMAGES IN A PRESSURE VESSEL STEEL. Brumovsky,

M. (Skoda, Plzen (Czechoslovakia)). 1975. 27p. Dep NTIS (US Sales Only) $4.50.

Radiation damage in nuclear reactor pressure vessel steels is affected by the initial stage of material. Among parameters that characterize this initial stage is pre-strain or strain-aging. A study of the interaction of strain and radiation damages was performed to indicate their linear summation rule. In tension tests the large effect of pre-strain has been proved, yield strength increases have been observed to be very dependent on their initial value. Model for that dependence has been proposed. Irradiation embrittlement is affected by the initial pre-strain for high neutron doses only (above cca 1×10^{19} n/cm^2), when effect of saturation is pronounced. Irradiation also increases the flow transition stress, but less than yield strength increase, so that "turbulent" flow for higher neutron doses starts just above yield strength. (5 references) (auth)

23992 CLEAN POWER: FOR THE NUCLEAR FUTURE. Nelken, H. H.; Barratt, R. O.; Mackenzie, S. J.; Essebaggers, J.; Gardner, W. A.; Walker, K. L. (Foster Wheeler Corp., Livingston, NJ). Heat Eng. (Livingston, N. J.); 45: No. 8, 129-144(1972).

The activities of the Foster Wheeler Corporation in designing and supplying steam generators and other primary circuit components are reviewed. Descriptions are presented of design verification procedures, helium-heated steam generators for the HTGR, the LMFBR demonstration plant steam generator system, moisture separator/steam reheater units for water cooled reactors, and the layout of the Panama City, Florida facility for manufacture of HTGR components. (HDR)

23993 PUMPS FOR NUCLEAR POWER PLANT. Conference Held at Bath, England, April 22–25, 1974. London; Mechanical Engineering Publications Ltd. (1974). 217p.

Twenty-two papers are presented which deal with the design, performance, and testing of coolant pumps for use in water-cooled and sodium-cooled reactors. Individual papers were separately abstracted and indexed in NSA. (DG)

For abstracts of individual papers see: 23558–23565, 23582, 23606, 23634–23644, and 23994.

23994 DEVELOPMENT PHILOSOPHY FOR NUCLEAR POWER PUMPS. Watkins, R. H. (Hayward Tyler and Co., Ltd., Luton, Eng.). pp 67-73 of Pumps for Nuclear Power Plant. London; Mechanical Engineering Publications Ltd. (1974).

From conference on pumps for nuclear power plant; Bath, Eng. (22 Apr 1974).

Some of the technical considerations and problems associated with the development of nuclear power pumps from the conceptual design phase to the testing of production units are described. The time, cost, and allocation of manpower for such development are surveyed. The resources necessary to survive in the component vendor market environment as an individual entity without affiliation with a large reactor combine are debated. (auth)

23995 EXPERIMENTAL STUDY OF THE ACTION OF TEMPERATURE ON A FRAGMENT OF A REACTOR. Dubrovskii, B. B.; Zholdak, G. I. Teploenergetika; No. 22, 185-189(1973). (In Russian).

A theoretical calculation and experimental study are made of crack formation as applied to a fragment of the cross section of shielding in a nuclear reactor for a complex, stationary temperature distribution. It is established that crack formation begins at relatively low temperature differences (30-40°C at absolute values of 50-60°C), intensifies with heating over the range 100-200°C and then stabilizes. Cracks are uniformly distributed around the perimeter, their opening not exceeding the permissible value of 0.4 mm. Loss of a significant amount of bound water occurs with the first heating, beginning at 60-80°C and continuing up to 110-150°C. Horizontal and vertical cracks, developing as the temperature increases as a result of developing temperature stresses, intersect at right angles. Reinforcement is necessary in the annular and vertical directions. It was experimentally established that the fragment of the cross section of the side shielding element of a nuclear reactor under the influence of calculated temperatures meets the requirements imposed for designs of this type. (JPRS)

23996 NUCLEAR REACTOR WITH SPACERS FOR FUEL RODS. Klein, K. W.; Rau, P. (to Siemens AG). Canadian Patent 966,592. 22 Apr 1975. 9p.

A description is given of a system for firmly supporting fuel rods by means of spacers within a nuclear reactor. The fuel rods have ribs arranged longitudinally around the circumference of the fuel rods. The spacers through which the fuel rods extend have pairs of projections which form slots within the interior circumference of the spacers. One rib of the fuel rods engages each slot in the spacer. As a result, the spacers provide tangential support for the fuel rods, rather than only radial support. (CA)

23997 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Wolff, P. H. W.; Peberdy, J. M. (to British Nuclear Design and Construction Ltd.). British Patent 1,382,797/B/. 5 Feb 1975. Filed date 4 Nov 1971. 11p.

Improved apparatus is claimed for handling reactor fuel subassemblies and other core components between the reactor and an adjacent component store. The apparatus is stated to afford more simple transfer, and with greater security, than is provided by current core component handling means. The apparatus maintains substantially vertical alignment. Full constructional details are given, together with application to reactor refuelling. The transfer means may comprise a pantograph mechanism. (UK)

23998 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Tidmarsh, J. J. (to British Nuclear Design and Construction Ltd.). British Patent 1,384,701/B/. 19 Feb 1975. Filed date 25 Feb 1971. 5p.

Reference is made to systems for restraining movement of reactor cores. Where a reactor core comprises a substantially rigid assembly of components, for example, a number of vertical parallel columns, it is necessary to provide for the restraint of horizontal movement of the core as a whole, but a difficulty arises in that the system must be sufficiently resilient to accommodate thermal expansion of the core in both horizontal and vertical directions. A system is described for overcoming this difficulty. (UK)

23999 PENETRATION OF VERTICAL JETS INTO FLUIDIZED BEDS. Merry, J. M. D. (Westinghouse Research Labs., Pittsburgh). AIChE (Am. Inst. Chem. Eng.) J.; 21: No. 3, vp(May 1975).

An expression was derived for predicting the penetration depth of vertical jets into fluidized beds based on the experimental observations of several workers. The expression correlates a wide range of data with reasonable accuracy and is suggested as a useful working equation for design purposes. (auth)

24000 STRESS ANALYSIS OF PRESSURE VESSELS IN NUCLEAR PLANTS. I. Stress Analysis of Pressure Vessels Without Openings. Kim, C. W.; Kim, S. Y. J. Korean Soc. Mech. Eng.; 14: No. 3, 233-239(1974).

A description is given of a computer program designed for the stress analysis of pressure vessels in nuclear power plants, ASME Code formulae are used. Numerical results are in good agreement with those of Kraus in the membrane stress region in the vessel. Higher stresses are presented near the corner of perforated plate rim-shell junctions. (Korean Sci. Abstr.)

24001 NUCLEAR ENGINEERING POWER PLANT COMPONENT. Worley, N. (Babcock and Wilcox Ltd., London). Chem. Eng. (London).; No. 296, 242-244(Apr 1975).

Some of the technical work associated with the development of heat exchangers and pressure vessels for nuclear power plants are reviewed. Flow modelling, heat transfer, corrosion, problems of vibration, boiler stability, stress analysis, and welding techniques are discussed. (UK)

24002 REACTOR CIRCULATING PUMP. Holz, H. (To Flein, Schanzlin and Becker, Aktiengesellschaft). British Patent 1,386,739/B/. 12 Mar 1975. Filed Date 1 Mar 1973. 5p.

The reactor circulating pump described comprises an electric motor, a casing supporting the motor, with a shaft rotatably mounted in the casing and driven by the motor. The casing includes a spigot portion at one end, with a passage extending through the spigot portion from an inlet duct provided in the casing, together with a turbine rotor and a circulating impeller mounted on the shaft. Means are provided to define an inlet passage that includes the afore-mentioned passage, and within which the turbine rotor is located. The shaft and impeller can be driven by fluid passing through the inlet passage from the inlet duct if the motor fails to deliver power, thus ensuring emergency cooling in the event of a current failure. The turbine rotor may be integral with the impeller, but separated there-from by a wall defining part of the inlet passage. A bypass may be provided between the working chambers of the turbine and the circulating pump. Advantages over conventional arrangements are enumerated. (UK)

24003 EVALUATION OF STARTING THERMAL STRESSES IN THE ROTOR OF THE LOW PRESSURE CYLINDER IN A TURBINE FOR A NUCLEAR POWER STATION. Leizerovich, A. Sh.; Lubny-Gertsyk, A. L.; Izrailev, Yu. L.; Kirillov, V. B. Therm. Eng.; 21: No. 8, 39-43(1974).

Temperature and stress distributions were calculated by the finite difference method. Results indicate the formation of high thermal stresses in heavy welded rotors when starting reheat turbines, a condition which requires an increase in the start-up

time in order to control the rate of increase in steam temperature. (DG)

24004 STEAM CYCLE POWER GENERATING INSTALLATION WITH A RESUPERHEATED DRYER. (to Societe Babcock-Atlantique). French Patent 2,215,837/D/. 26 Jan 1973. 7p. (In French).

The invention provides improvements in steam cycle thermal power stations using a resuperheater dryer. The water contained in the superheater-dryer is selectively sent to the boiler water-feed line or to an evaporator fed with heating fluid by a heat-accumulator, which in turn is fed by the thermal source of the installation, so as to provide extra-power at peak periods and increase the accumulator restoring capacity. This can be applied to nuclear power stations generating steam with a low degree of superheating. (FR)

24005 POWER GENERATOR ASSOCIATED WITH A HEAT ACCUMULATOR AND WITH A DEVICE USING FOSSIL FUEL. (to Societe Babcock-Atlantique). French Patent 2,215,836/D/. 26 Jan 1973. 9p. (In French).

The invention provides improvements in motive power installations with a heat accumulator. The exhaust gases of a gas turbine give up their heat to a coolant fluid prior to being evacuated through a chimney. The heat thus transferred is stored in a liquid medium in a tank and is used by a steam cycle expansion engine according to requirements. The turbine combustion chamber is fed with fuel at least partly from said tank. This can be applied to thermal power stations supplying a network with variable requirements. (FR)

24006 IMPROVEMENTS IN STEAM CYCLE THERMAL POWER STATIONS. (to Societe Babcock-Atlantique). French Patent 2,215,834/D/. 26 Jan 1973. 6p. (In French).

The invention provides improvements in steam cycle thermal power stations. The power station adapted to supply a network with variable requirements is provided with a heat accumulator. A feedwater re-heater using steam from the steam generator is mounted downstream of the water-station. This arrangement permits a substantial increase in the temperature of the water admitted into the steam generator and allows the accumulator to restore the heat accumulated at a higher-rate at peak periods. This can be applied to power stations, the basic thermal source of which is adapted only to moderate working conditions. (FR)

24007 COVER LOCKING DEVICE FOR PRESSURIZED ENCLOSURES. Costes, D. (to CEA). French Patent 2,216,863/D/. 6 Feb 1973. 12p. (In French).

A system for locking two members by moving apart two substantially parallel opposite plane surfaces is described. This system comprises two compression members, both provided at each end thereof with a rolling track, said members being applied against each other along one of their rolling-tracks and respectively resting against said two plane surfaces along their other rolling track. The rolling tracks have in the plane of movement radii of curvature R_1 and R_2 greater than half the length of the respective member. Means are provided for exerting a lateral thrust on at least one of said two members, said two members being in addition each provided with means for causing them to roll without sliding. The system can be used for locking the plug of a nuclear reactor. (FR)

24008 METHOD AND DEVICE FOR PRESTRESSING THE PLUG OF A NUCLEAR REACTOR VESSEL. Aubert, G. (to CEA). French Patent 2,215,672/A/. 26 Jan 1973. 11p. (In French).

The invention relates to the prestressing of a plug on its seat, achieved by associating the mechanical clamping of that plug with a thermal expansion. That method provides for the association of a plurality of means for mechanically clamping the plug to its seat, with means for temporarily modifying the lengths of the mechanical clamping means through at least one temperature variation. The invention can be applied to the low-power jacks for displacing locking wedges such as used with pressurized enclosures. (FR)

24009 HEBEZEUGE IN KERNTECHNISCHEN ANLAGEN. Entwurf 10/74. (Lifting Devices in Nuclear Facilities. Draft 10/74). Cologne; Heymann (1974). 9p. (In German).

Safety specifications are listed for elevators, cranes, hoists, crane carriage, load lifting devices, and fuel element charging machines of LWRs. (GE)

Reactor Fuels

Refer also to abstracts 22067, 22069–22072, 22076, 22078, 22080, 22251, 22764–22768, 22805, and 22843.

24010 (CONF-701074-P3, pp 390-416) ESTIMATION OF THE WORKING CAPACITY OF FUEL JACKETS OF FAST REACTORS. Likhachev, Yu. I.; Proshkin, A. A.; Shcherbakova, Zh. N. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5–10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

Methods of determining the stressed and strained states of the jacket of the hermetic cylinder of fast reactor fuel elements are examined. It is assumed that the jacket is loaded with internal pressure of gaseous fission products which have come from the fuel into the compensation volume and the pressure from the swelling fuel directly in contact with the jacket. The use of the theory of strengthening and of the method of solving the problem in increments of the components permits examining the work of the jacket both for a constant reactor power and in transient processes. Creep strains of the fuel and jacket and the possibility of the appearance of instantaneous strains are taken into consideration, both during operation at the rated load and in transient conditions. The solution permits considering the influence of irradiation on the long and short term mechanical properties of the material of the jacket and fuel. The influence of azimuthal irregularity of the temperature distribution on the working capacity of the fuel jacket is evaluated. The solution permits considering the influence of irregular swelling of the material of the fuel and the material of the jacket. The working capacity of the fuel jacket is estimated with respect to both the long-term strength (on the basis of the hypothesis of the summation of damages) and the intensity of accumulated strain during the service life. The results of calculations of the strength of the fuel element of a fast reactor with a jacket of austenitic steel and fuel pellets of sintered uranium dioxide are presented. (auth)

24011 (HEDL-SA-757) NEUTRON RADIOGRAPHY OF FUEL PINS. Jackson, C. N. Jr.; Powers, H. G.; Burgess, C. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. 45p. (CONF-750235-1) Dep. NTIS $5.25.

From symposium on practical applications of neutron radiography and gauging; Gaithersburg, Maryland, USA (10 Feb 1975).

Neutron radiography performed with a reactor source has been shown to be a superior radiographic method for the examination of unirradiated mixed oxide fuel pins at the Hanford Engineering Development Laboratory. Approximately 1,700 fuel pins were contained in a sample that demonstrated the capability of the method for detecting laminations, structural flaws, fissile density variation, hydrogenous inclusions and voids in assembled fuel pins. The nature, extent, and importance of the detected conditions are substantiated by gamma autoradiography and by destructive analysis employing alpha autoradiography, electron microprobe and visual inspection. Also, a series of radiographs illustrate the response of neutron radiography as compared to low voltage and high voltage x-ray and gamma source Iridium 192 radiography. (auth)

24012 (JUL-11(Bd.1), pp 71-84) PHYSICAL-CHEMICAL ASPECTS AS TO THE ABILITY OF HTR-NUCLEAR FUELS OF RETAINING FISSION PRODUCTS, STUDIED BY MEANS OF HIGH-TEMPERATURE MASS SPECTROMETRY. Hilpert, K.; Gerads, H.; Foerthmann, R. Nov 1974. (In German).

From workshop in modern analytical methods; Juelich, F. R. Germany (15 Oct 1973).

3 figs.; 1 tab.; 9 refs. Available from ZAED.

In workshop on modern analytical methods. Vol. I. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie).

Investigations were carried out on UO_2 model cores, with and without the addition of Al_2O_3, on the retention of solid fission products, in particular strontium and barium. High temperature mass spectrometry using a Knudsen cell was taken as the experimental method. The apparatus used and the method are described. The evaporation behaviour of the compounds in the binary system $BaO-Al_2O_3$ was mass spectrometrically investigated in order to obtain ways of possible improvement of fission product retention in the fuel kernel through spinel formation. Further investigations were then carried out on BaO-doped uncoated UO_2 model cores with and without the addition of Al_2O_3 and also on a few coated particles. It is shown that the barium largely evaporates from the surface of the cores as BaO, and from the coated surface as elementary barium, which leads to the conclusion that there is a reduction of barium oxide by penetrating the coating. An attempt is made to interpret the measured Ba pressures above the coating of the particles with and without Al_2O_3 addition. (GE)

24013 IMPROVEMENTS IN OR RELATING TO THE DECONTAMINATION OF FUEL ELEMENT SHEATHS. Robertson, R. I.; Orr, T. F. (to British Nuclear Fuels Ltd.). British Patent 1,382,915/B/. 5 Feb 1975. Filed date 25 Apr 1972. 4p.

It is stated that during the loading and vibro-compaction of granular nuclear fuel into sheaths to produce nuclear fuel elements the top part of the sheath may become contaminated by fuel dust which may be ground into the surface of the sheath. It is desirable to remove this contamination since it can interfere with manufacture and reactor operation, but wet processes cannot be used since the sheath is not sealed and liquid must not reach the fuel. Normal dry methods also tend to be inefficient and to spread the contamination. In the method described the sheath is rotated under a sparking electrode, keeping the area under spark attack under cover of inert gas. By traversing the electrode along the length of the sheath and suitably adjusting the speeds of rotation and traverse, decontamination of a continuous area of the sheath can be achieved. Suitable apparatus is described. (UK)

24014 IMPROVEMENTS IN OR RELATING TO LOCATING GRIDS. Allsopp, P. J. (to United Kingdom Atomic Energy Authority). British Patent 1,386,424/B/. 5 Mar 1975. Filed date 15 Mar 1972. 7p.

Reference is made to grids that may be used to locate nuclear reactor fuel pins in fuel element assemblies. Conventional type grids suffer from two disadvantages. Firstly, the restraint of lateral movement within the cells can result in damage to the pins if they expand during their working life; scoring and corrosion of the pin cladding can result. Secondly, the large number of interconnected strips produces a large pressure drop in the coolant. The object of the invention is to provide a form of grid that lessens these problems. A number of metal strips are interconnected to form walls that contact each fuel pin at only two locations not diametrically opposed. Projections are formed for making contacts. A number of different geometrical arrangements are described. (UK)

24015 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENT ASSEMBLIES. Raven, L. F. (to British Nuclear Fuels Ltd.). British Patent 1,382,471/B/. 5 Feb 1975. Filed date 13 Jan 1972. 10p.

Reference is made to spacer grids for cluster type fuel elements. The spacer grid described comprises a number of cojointed cylindrical ferrules each adapted to receive a nuclear fuel pin and each having a pair of circumferentially spaced rigid stop members extending inside the ferrule and a spring locating member attached to the ferrule and extending inwardly from the ferrule wall so that its line of action is in opposition to and between the stop members that lie in the same diametric plane. Some of the cylindrical ferrules have a rim shaped so as to promote turbulence in coolant fluid flowing through the grid. The cylindrical ferrules are preferably joined by welding or brazing at their lines of contact so as to form a polygonal array that can be bounded by side plates, without the need for a peripheral band. Constructional details are fully described. (UK)

24016 PLUTONIUM RECYCLING IN THE USA AND WESTINGHOUSE'S ANDERSON PLANT. Com. Naz. Energ. Nucl., Not.; 21: No. 4, 71-72(Apr 1975). (In Italian).

Some brief data on the state of plutonium recycling in the U. S. are followed by a description of the Pu fuel fabrication plant which Westinghouse plans to build at Anderson. (auth)

24017 FABRICATION AND INSPECTION OF STAINLESS-STEEL-CLAD TUBES FOR FAST REACTORS. Spriet, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. de Developpement des Elements Combustibles); Jacson, M. (Vallourec, 75 - Paris (France)). pp 227-230 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

The production of cladding tubes requires a selection of the raw material, particular care taken during the cold and hot processes, special surface preparations, heat treatments, and intermediate control during the principal steps of fabrication. The inspection stages include eddy current and ultrasonic tests, metrology of internal and external diameter and thickness, metallography, tensile tests, and mechanical tests at high temperature. (FR)

24018 SPECIFICATIONS: ARE THEY ALL MEANINGFUL. Huet, J. J. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). pp 230-231 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

A few examples from fuel assembly technology are examined including: filling gas, radiography of the welds, dimensions of the pellets, end cap stringers, straightness of the fuel element tubes, and hexagonal wrapper tubes. (FR)

Reactor Control Systems

Refer also to abstract 23952.

24019 (CONF-701074-P3, pp 86-95) OPERATION EXPERIENCE AND IMPROVEMENT OF THE CONTROL SYSTEM OF BUDAPEST REACTOR. Pallagi, D. 1970. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivne Tsikly, Radiatsionnoe Materialovedeniet," Ulyanovsk, 5-10 Oktyabrya 1970 G. Vol. III.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials."

The many year experience of operation is described including the control system and several modifications and additions. It is established that the working of the control system is dependable and conforms to its purpose. The change of the system to full control with a computer is considered well founded. (auth)

24020 (WANL-TME-103) NERVA POWER RANGE ANALYSIS. Maguire, A. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Aug 1962. 20p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The equations describing the NERVA heated bleed system have been implemented on the analog computer for analysis and design of power range control systems. The mathematical model was based on preliminary data and will be modified as changes occur in the design of components and as experimental data becomes available. Several new features have been incorporated in this model to improve the accuracy. The reactor simulation was a three-section, B-4 core. The mass considered was the total fueled graphite and cladding, neglecting the mass of the tie bolt assemblies. All of the coolant flowed thru the core channels, i.e. the 6% tie-rod-annulus flow was treated as channel flow. The compressibility factor is developed as a function of temperature. Hydrogen properties and data were taken from Hydrogen Properties for Project Nerva WANL-TNR-043. The heat transfer coefficient, h, was represented as a function of flow rate to the eight-tenths power and bulk-to-wall temperature ratio to the fifty-five hundredths power. The inclusion of the temperature ratio term brought the representation one step closer to the exact analytical expression for the coefficient. Also, it was hoped that the results would indicate the magnitude of error in eliminating this term and assuming h as a function only of flow rate to the eight-tenths power. Other described improvements in the model are presently being evaluated. (auth)

24021 (WANL-TME-270) NERVA ENGINE REACTOR CONTROL SYSTEM: PRELIMINARY SYNTHESIS AND ANALYSIS. Hafer, J. F.; Hohmann, G. L.; Maguire, A. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Feb 1963. 116p. Dep. NTIS $9.00.

Declassified 21 Jul 1975.

The design and analysis of a duo-mode control system which may be used to control the NERVA reactor are presented. The system contains a subpower section which will control the reactor between source level and approximately 1% power, and a power range section which will control between 1% and 100% rated power. Although no attempt was made at final optimization of the parameters in the control system, it was determined from the transient and stability analyses that the values selected are near optimum for use with the present analog models of the reactor. A preliminary analysis was made to determine the capability of this system to control the reactor during an initial startup from source level, and a shutdown and restart from any power level. The analog analysis was performed using the B-4 core and tie rod models described in WANL-TMI-333 and WANL-TMI-369, respectively. Other equipment which was synthesized (i.e., actuator, control drums, etc.) is described. The breadboard analysis section contains a description of the functional operations of the "breadboard" control system including the necessary switching between the two operational modes to maintain continuous control of the reactor through all phases of operation. The proposed NERVA Reactor Reference Control System is capable of con-

trolling the reactor through all phases of operation i.e., subpower startup, power range operation, shutdown, and restart, with acceptable response and stability using a closed-loop type of operation at all times. (auth)

24022 (WANL-TME-312) EFFECT OF THE WANL REFERENCE REACTOR CONTROL SYSTEM ON ENGINE PRESSURE CONTROL. Miller, R. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Apr 1963. 43p. Dep. NTIS $5.25.

Declassified 22 Jul 1975.

The effect of the WANL reference engine reactor control system upon the forward transfer function of the pressure control loop (chamber pressure versus turbine power control valve area) is derived. Both the calculated transfer function and the transfer function as measured from the analog computer simulation of the engine show no adverse resonance effects at any frequency and a phase shift of 90° at higher frequencies. These results are interpreted as a strong indication that the reactor control system analyzed should not cause any deleterious interaction between the reactor control system and the pressure control system nor should it impose any severe problem in the design of the pressure control system. The analysis was performed by linearizing the entire system about the design operating point. Operation of the analog computer simulation over the entire operating map in previous studies has indicated no instabilities or oscillations and implies that the conclusions reached for the design point are applicable to the entire operating map. (auth)

24023 (WANL-TME-347) NUCLEAR SUBSYSTEM CONTROL AND ITS INTEGRATION INTO ENGINE CONTROL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 May 1963. 33p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

Recommendations are made with respect to three aspects of the control system: selection of the over-all engine control system which best meets the current NERVA requirements;establishment of an appropriate interface between the nuclear subsystem control and the balance of the over-all engine control system; and definition of goals for future control system development. The criteria for the over-all NERVA engine control system are the following: the control system should be chosen to provide the maximum over-all engine reliability; the control system should ensure adequate performance of the engine; and the control system should be one which offers maximum feasible protection from system malfunction to the vital engine components. The control systems being considered for the NERVA engine consist basically of a reactor power level controller and a propellant feed controller coupled by a programmer and linked by the dynamics of the over-all engine system. The overall engine system recommended meets the requirements of overall engine reliability and performance and provides greater protection for the reactor in the event of system malfunction than does any competing system. As a definition of the control system interface, Westinghouse recommends that the neutron flux loop and the reactor temperature loop be made part of the nuclear subsystem with the balance of the over-all control system an Aerojet responsibility. Our analysis indicates that the over-all control system is separable into two distinct parts: one, the propellant feed controller which determines the engine propellant flow rate and thus over-all thrust output of the engine; and two, the reactor power level controller which determines the operating temperatures within the reactor. As to future developments, our recommendations are toward simpler, more reliable systems. In particular, systems which permit mission accomplishment even with some control system malfunction are desirable. (auth)

24024 (WANL-TME-380) DISCUSSION OF APPROACHES TO MALFUNCTION ANALYSIS. Stubbs, G. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Jun 1963. 11p. Dep. NTIS $4.00.

Declassified 21 Jul 1975.

The approach used in studying the effects of malfunctions of the reactor (and engine) control system and means which can be provided in the control system for correcting or bypassing these malfunctions are discussed. First, studies are being made to determine the transient behavior of the engine and its controls when each of the contemplated malfunctions occur, assuming that no corrective control action is applied. Second, on the basis of these studies it is being determined how the presence of each malfunction can be determined by appropriate measurements of the engine variables. Third, a study is being made to find out what emergency control procedures can be followed to counteract each malfunction. And fourth, the results of these studies of malfunctions and emergency control procedures are being factored into the control system synthesis program. It should be emphasized that the basic design of the reactor control system will be determined primarily by the normal operational requirements rather than the more severe transient excursions that may result from malfunction. Also, the intent in developing the reactor controls is to provide reliable implementation that will not require duplication. However, this policy does not remove the necessity for making malfunction studies nor does it preclude the possibility of developing a normal control system which can continue to operate in spite of certain malfunctions. Also, the development of a reactor shutdown control system that will perform satisfactorily under a variety of malfunctions leading to shutdown is an aspect of control development directly dependent on malfunction studies. The results of the malfunctions studies can affect the design of the reactor control system in a number of ways. Several examples are discussed in more detail. (auth)

24025 (WANL-TME-530) NRX-A1 AND A2 CONTROL SYSTEM, FINAL REPORT: CY 63. Elmiger, R. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 30 Sep 1963. 147p. Dep. NTIS $10.50.

Declassified 11 Sep 1973.

A review of Test Cell A control systems capabilities was carried out to determine their adaptability to the NRX reactor test program. It was determined that by augmenting the existing reactor control equipment, the Test Cell A capability could be enhanced and the control system flexibility required by NRX could be achieved. Such augmentation has been provided by WANL. The supplementary equipment designed and built at WANL is not fixed to specific control characteristics but is flexible so that anticipated control requirements can be readily and reliably mechanized. The heart of the equipment is the Controller/Sequencer which is a miniature analog computer with the capacity of handling NRX control as well as auxiliary side-by-side checkout of advanced NRX reactor control concepts. Additional nuclear instrumentation and an automatic power range switch is provided in anticipation of NERVA startup transient tests on NRX reactors which will require automatic control from source level to full power. To provide flexibility and to satisfy control concepts which require programming of certain reactor parameters as a function of other parameters, variable base programmers are provided to supplement the present time base programmers used for the KIWI tests. Because of the need to perform rod worth measurements and other sub-power range physics experiments, individual drum control has been added to the facility capability. Automatic cooldown equipment has been added to provide pulsed coolant flow for decay heat removal and a low purge flow to maintain a low positive pressure in the core between pulses to prevent air from entering and oxidizing the core. The design of the above supplementary control equipment and Test Cell A control capability are discussed in detail. (auth)

24026 CONTROL ROD DRIVE MECHANISM. (to Hollandse Signaalapparaten BV). Netherlands Patent 7,214,135/A/. 19 Oct 1972. 13p. (In Dutch).

The invention consists of an improved hydraulic control rod drive mechanism for water cooled reactors. Each drive mechanism has the same velocity and the same starting and stopping time, which are the necessary conditions to obtain an equal burnup of the reactor core. (NL)

24027 CONTROL APPARATUS FOR NUCLEAR REACTORS. Hickson, M. R. (To Clarke-Chapman Ltd.). British Patent 1,384,564/B/. 19 Feb 1975. Filed Date 8 May 1972. 5p.

The apparatus described comprises a U-shaped guide. One limb of which guides a weight and the other limb guides a neutron absorber element; the weight and the element are connected by a flexible member extending around the base of the guide. Means are provided in the first limb for holding the weight in an upper position, for releasing it, and for lifting it to restore it to its upper position. The arrangement is particularly suitable to reactors in which the core and the coolant are contained in a primary vessel, all servicing and control facilities being accessible at the top of the vessel; Na-cooled fast reactors are examples. The apparatus enables the absorber elements to enter the core from below, whilst the control operating means is accessible at the top of the primary vessel. The arrangement is particularly applicable as a secondary shut-down control. (UK)

24028 MEASUREMENT IN THE NUCLEAR POWER INDUSTRY. Rippon, S. Metron; 7: No. 5, 122-126(May 1975).

The instrumentation required in nuclear power plants has remained close to the simple principles but has called for huge numbers of rugged instruments capable of operating in hostile environments and feeding into control systems of unprecedented overall reliability. For this reason the development of instrumentation for nuclear power plants has to a large extent proceeded

independently of nuclear research instruments and is usually marketed by different manufacturers. The safe and reliable operation of a nuclear power plant depends on the measurement of many other parameters in addition to the levels of radiation. In fact extensive temperature measurement is more important for control of power output during normal operation, and pressure and flow measurements are of great importance in monitoring plant status. (auth)

24029 CONTROL ROD DRIVE FOR NUCLEAR REACTORS. Gassert, H.; Rohark, G. (To Brown, Boveri und Cie AG). German(FRG) Patent 1,789,017/B/. 16 Jan 1975. 3p. (In German).

A control rod drive is described which allows reliable control rod insertion against higher resistance, as in a pebble-bed reactor. (GE)

24030 METHOD OF MONITORING THE OPERATIONAL PERFORMANCE OF A NUCLEAR REACTOR BY MEANS OF NEUTRON DETECTORS. Loving, J. J. Jr. (To Westinghouse Electric Corp.). German(FRG) Patent 2,432,566/A/. 30 Jan 1975. 27p. (In German).

A description is given of a method of monitoring the operational performance of a nuclear reactor with the aid of several mobile in-core neutron detectors which are inserted into the reactor core in accordance with a given intermittent schedule and then moved through the core along a fixed path. The signal emitted by the detectors is recorded as a function of their position relative to the core. (GE)

24031 NEUTRON DETECTOR. Goldstein, N. P.; Todt, W. H. (To Westinghouse Electric Corp.). German(FRG) Patent 2,430,295/S/. 30 Jan 1975. 11p. (In German).

A self-powered neutron detector is described which is suitable for the use in the core of a reactor due to its long-term reliability. Cobalt or gold is used as emitter material, the thin conducting layer consists of platinum, lead or bismuth, the insulator of magnesium or aluminium oxide. (GE)

Nuclear Power Plant Economics

24032 (CEA-R-4684) SYNOPSES OF NUCLEAR ENERGY DEVELOPMENT FOR THE YEAR 2000: APPLICATION OF THE SMIC 74 METHOD. Duperrin, J. C.; Godet, M.; Puiseux, L. (CEA, 75 - Paris (France). Dept. des Programmes). Jul 1975. 64p. (In French). Dep. NTIS (US Sales Only) $6.25.

This article reports the results of a joint study conducted by the C. E. A. Programs Department and the E. D. F. Service of General Economics Research since 1973. In the first stage about sixty variables were taken by common consent as liable to influence directly or indirectly the long-term development of nuclear energy (technical progress, ecological obligations, economic and political factors...). A "structural analysis matrix" was then drawn up to find out the influence (or lack of influence) of each variable on each of the others. At the end of this first stage the main aspects of nuclear energy development by the year 2000 were summed up by six events or situations which may arise and influence it. From the subjective probabilities (individual and conditional) estimated by people questioned on these six events the new method of crossed impacts "SMIC 74" gives three kinds of results: firstly, it established the consistency in probability terms of all replies given by an expert on the events studied. Secondly, it builds and grades the possible nuclear energy development synopses of which there are $64 = 2^6$, i.e., as many as there are combinations of events. Thirdly, it performs a strategical sensitivity analysis, i.e., an estimate can be made of the way in which the whole system of events is affected by any actions taken by decision-makers to promote or delay the development of one event or another. (auth)

24033 (CONF-7310110-, pp 37-45) USE OF LARGE NUCLEAR POWER PLANTS FOR HEAT SUPPLY AT LARGE DISTANCES FROM THE CONSUMER. Gunderman, E. (Technical Univ., Dresden). 1974. (In Russian).

From conference on nuclear power plants and containment; Brno, Czechoslovakia (3 Oct 1973).

In conference on nuclear power plants and containment.

The factors affecting the economic viability of the use of large nuclear power plants for supplying heat to consumers at great distances are analyzed. The technical and economic study showed that for the German Democratic Republic nuclear power plants with 440 MW water reactors would be economically feasible for supplying heat to an area heating system. (JSR)

24034 (CONF-7310110-, pp 62-73) FEASIBILITY OF A SINGLE-PURPOSE REACTOR PLANT FOR DISTRICT HEATING IN FINLAND. Tarjanne, R.; Vuori, S.; Eerikainen, L.; Saukkoriipi, L. (Technical Research Centre of Finland, Helsinki). 1974.

From conference on nuclear power plants and containment; Brno, Czechoslovakia (3 Oct 1973).

In conference on nuclear power plants and containment.

The high price of conventional fuels, coupled with the cold climate prevalent in Finland, has led to a feasibility study of a single-purpose reactor for district heating. The reactor chosen is of ordinary pressurized water type with a thermal output of 100–200 MW. In the primary circuit of the heating reactor plant, the steam generators employed in ordinary PWR's are replaced by water-water heat exchangers. For safety reasons an intermediate circuit separates the primary water from the network water. The conditions of the district heating systems of Finland were taken into account, and led to choice of an average temperature of 160°C for the reactor coolant and a pressure of 13.5 bar. By virtue of this low design pressure and the minimal control requirements, it was practicable to design the plant in a way that was essentially simpler than ordinary reactor plants. When a heating reactor satisfies the base heat demand in a district heating system, in which oil-fired heating plants alone, or together with dual-purpose conventional heating power plants produce the remainder of the heat demand, the effective annual full-power operation time of the heating reactor is from 5000 h up to 7000 h. Economic comparisons have indicated that the heating reactor may be competitive when the operation period is of this order. As the heating reactor has to be located near the heat consumption area for reasons of economy, the safety aspects are of major importance, and may in themselves preclude realization of the heating reactor idea. (auth)

24035 (ORNL-4995) ASSESSMENT OF INDUSTRIAL ENERGY OPTIONS BASED ON COAL AND NUCLEAR SYSTEMS. Anderson, T. D.; Bowers, H. I.; Bryan, R. H.; Delene, J. G.; Hise, E. C.; Jones, J. E. Jr.; Klepper, O. H.; Reed, S. A.; Spiewak, I. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 330p. Dep. NTIS $10.60.

Industry consumes about 40 percent of the total primary energy used in the United States. Natural gas and oil, the major industrial fuels, are becoming scarce and expensive; therefore, there is a critical national need to develop alternative sources of industrial energy based on the more plentiful domestic fuels--coal and nuclear. This report gives the results of a comparative assessment of nuclear- and coal-based industrial energy systems which includes technical, environmental, economic, and resource aspects of industrial energy supply. The nuclear options examined were large commercial nuclear power plants (light-water reactors or high-temperature gas-cooled reactors) and a small [approximately 300-MW(t)] special-purpose pressurized-water reactor for industrial applications. Coal-based systems selected for study were those that appear capable of meeting environmental standards, especially with respect to sulfur dioxide; these are (1) conventional firing using either low- or high-sulfur coal with stack-gas scrubbing equipment, (2) fluidized-bed combustion using high-sulfur coal, (3) low- and intermediate-Btu gas, (4) high-Btu pipeline-quality gas, (5) solvent-refined coal, (6) liquid boiler fuels, and (7) methanol from coal. Results of the study indicated that both nuclear and coal fuel can alleviate the industrial energy deficit resulting from the decline in availability of natural gas and oil. However, because of its broader range of application and relative ease of implementation, coal is expected to be the more important substitute industrial fuel over the next 15 years. In the longer term, nuclear fuels could assume a major role for supplying industrial steam. (auth)

24036 STORING ELECTRICAL ENERGY ON A LARGE SCALE. Gardner, G. C. (Central Electricity Research Labs., Leatherhead, Eng.); Hart, A. B.; Moffitt, R. D.; Wright, J. K. CEGB Res.; No. 2, 12-20(May 1975).

Large-scale electricity storage for the CEGB supply system will become increasingly attractive as the proportion of nuclear generating plants increases. By the 1990s, it may be desirable to employ storage widely in order to protect nuclear plants from the need to reduce power at night. At present, the limited storage capacity of pumped-water schemes is sufficient to provide prompt emergency generation in case of unexpected plant failure elsewhere on the system. As time goes on, storage will become economic for the additional role of absorbing off-peak nuclear power for regeneration at times of peak demand. A survey of possible high-capacity storage schemes for this purpose suggests that the cheapest is to store hot water bled from power-station feed heaters. But there are other promising possibilities, among them electrochemical batteries and a novel combined storage of compressed air and heat. More exotic systems, including flywheels and superconducting magnets are unlikely to be economical. (auth)

24037 REVIEW OF ONTARIO'S NUCLEAR PROGRAM. Woodhead, L. W. (Hydro-Electric Power Commission of Ontario, Toronto). B. C. Prof. Eng.; 26: No. 3, 16-20(Mar 1975).

The more recent significant events, progress, and plans that have taken place in Ontario Hydro's nuclear program up to the end of October 1974 are reviewed, with emphasis on the following: performance of Pickering GS-A (Units 1-4), performance of Bruce Heavy Water Plant, status of Bruce GS-A (Units 1-4), expansion Program for nuclear-electric generation, expansion program for heavy water production, expected nuclear-electric energy contribution in Ontario to 1990. (auth)

24038 ENERGY MEMORANDUM. The Hague; Staatsuitgeverij (1974). 232p. (In Dutch).

A survey is presented of the Netherlands' national and the world's total energy sources, their carriers, and their availability. An estimate is given of future demands as well as national "energy balances" for 1980 and 1985. Guidelines for future policy are outlined comprising the aspects of licensing policy, stimulation of and investment in research, and the development of existing as well as alternative energy sources. Nuclear power production, the ultracentrifuge project and the fast breeder reactor project receive special attention. (NL)

24039 NUCLEAR RESOURCES IN THE ENERGY FIELD. Franco, G. (CNEN, Rome). Com. Naz. Energ. Nucl., Not.; 21: No. 4, 49-65(Apr 1975). (In Italian).

From congress on development status of research areas of (photochemistry, radiation chemistry, radiochemistry, and nuclear chemistry; Rome, Italy (12 Mar 1975).

A brief review is presented of the following main subjects: (1) the consumption trend in Italy, (2) the share of primary sources in energy consumption, (3) the sources of energy supply, and (4) the end uses of energy. Energy development prospects are discussed, with particular regard to the role of nuclear energy and to the structures for the utilization of nuclear energy. (auth)

24040 FINANCING OF NUCLEAR POWER PLANTS AND ITS CURRENT PROBLEMS. Bonnet, M. Com. Naz. Energ. Nucl., Not.; 21: No. 4, 39-47(Apr 1975). (In Italian).

From 20th nuclear congress; Rome, Italy (Mar 1975).

The financing of nuclear programs involves many and difficult problems because of the size of the investments required in the sector of electric power plants, and particularly nuclear ones. These problems, which are particularly heavy for the power utilities, are discussed. (auth)

24041 CURRENT PROBLEMS RAISED BY THE ACCELERATION OF NUCLEAR POWER PROGRAMS. Moretti, M. Com. Naz. Energ. Nucl., Not.; 21: No. 4, 31-37(Apr 1975). (In Italian).

From 20th Nuclear Congress; Rome, Italy (Mar 1975).

The factors are listed which have caused nuclear fission energy to practically constitute—at least for the countries like Italy which largely depend on imports for their supply of primary energy sources—the only effective industrial alternative to meet electric power sources—the only effective industrial alternative to meet electric power requirements, waiting for other sources to become available. A summary review is made of the main problems of a technical, financial and socio-economic nature connected with the implementation of a substantial nuclear power plant program in the framework of the Italian situation, which envisages by 1985 the operation of a complex of nuclear power plants for a total capacity in the order of 20,000 MW(e). (auth)

24042 OFFSHORE POWER PLANTS STUDIED IN GERMANY. Com. Naz. Energ. Nucl., Not.; 21: No. 4, 73-77(Apr 1975). (In Italian).

An account is presented of a German investigation on the possibilities of building offshore power plants in the North Sea. (auth)

24043 NUCLEAR POWER INDUSTRY IN EUROPE. Greenhalgh G. H. (British Nuclear Forum, London). Energ. Nucl. (Milan); 22: No. 6, 320-325(Jun 1975).

From 20th nuclear congress; Rome, Italy (20 Mar 1975).

The nuclear industrial capacities in Europe are reviewed in order to assess to what extent the European nuclear power industry can face the requirements determined by the expansion of the various national nuclear power programs caused by the present energy crisis. After evidencing the excessive fragmentation of the European nuclear industry, which however as a whole would seem to be up to its tasks, the author supports the necessity of the formation of a European homogeneous market, mainly through standardization of designs, authorization procedures, quality assessments, etc. Foratom is suggested as the organization suitable for accomplishing this aim. The European situation in the fuel cycle field is also considered, and the joint actions undertaken to assure future supplies are mentioned. (auth)

24044 SITUATION AND PROSPECTS OF THE ITALIAN NUCLEAR INDUSTRY. Puri, A. Com. Naz. Energ. Nucl., Not.; 21: No. 3, 33-40(Mar 1975). (In Italian).

24045 POSITION OF FRANCE IN NUCLEAR ENERGY. Giraud, A. (CEA, 75 - Paris (France)). Rev. Gen. Nucl.; 1: No. 1, 5-13(Feb 1975). (In French).

The main aspects of the French nuclear power program, comprising in the immediate future enriched uranium and light water reactors with the gradual introduction of fast neutron reactors, are reviewed. The nuclear fuel cycle from the supply of natural uranium to reprocessing the spent fuel is considered. The role of nuclear energy which is called upon to solve the problem of replacement of oil reserves is discussed. (FR)

24046 THOUGHTS ABOUT QUALITY ASSURANCE DURING ELECTRICITE DE FRANCE NUCLEAR POWER PLANT OPERATION. Feger, M. (Electricite de France, 75 - Paris. Service de la Production Thermique). pp 210-212 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

Thinking on the operating quality guarantee is presented from the experience acquired in the last 11 years of French nuclear power station operation and from what is known about power station abroad (regulation aspects of the problem, reduction of human errors and their consequences, personnel qualification, working methods, quality control). The organization used in the Fessenheim power station, which is scheduled for service at the end of 1975, is explained. (FR)

24047 QUALITY ASSURANCE PROGRAM FOR EDF NUCLEAR POWER PROJECT. Milliat, J. P. (Electricite de France, 75 - Paris. Direction de l'Equipement); Vaujour, J. A. (Electricite de France, 75 - Paris. Service Controle des Fabrications. pp 212-213 of La Maturite de l'Energie Nucleaire. Lehoulier, J.; Mantega, M. (eds.). Clamart, France; Societe Francaise de l'Energie Nucleaire (1975). (In French)

From 1st European nuclear conference; Paris, France (21 Apr 1975).

EDF and contractor experience in quality assurance program implementation is discussed. (FR)

24048 ENERGY SUPPLY UNTIL THE YEAR 2000. Ailleret, P. Arch. Energiewirtsch.; 29: No. 4, 327-338(Apr 1975). (In German).

The much disputed problem of the estimation of the true oil reserves available is discussed. Further topics of discussion are possible energy saving measures, other fuel reserves, future oil discoveries, tar sands and oil shale as well as the connection between nuclear energy and electricity. The planning is discussed of putting 6 to 7 1,000 MW(e) nuclear power plants into operation in France from 1979 onwards and to gradually shut down operation of oil-fired power plants. Electricity is to become increasingly significant as a secondary energy. The use of nuclear energy for other purposes besides the generation of electricity is discussed, and the possibility of hydrogen being an advantageous secondary energy carrier in the year 2000 is dealt with. (GE)

24049 NUCLEAR POWER GENERATION. Schmidt, G. Brennst.-Waerme-Kraft; 27: No. 4, 141-146(Apr 1975). (In German).

A general survey is given of nuclear energy application in the German Federal Republic at present and in the near future, and special nuclear power facilities are described which will sooner or later serve the power economy of a number of states. Also discussed are problems of ecology and safety, fuel cycles, conventions, and organizations. (GE)

24050 POWER ECONOMY OF BULGARIA. Kovatschew, D. Arch. Energiewirtsch.; 29: No. 4, 338-342(Apr 1975). (In German).

2 figs. Translated from Energochozjajstvo za rubezom no. 5 (1974) p. 1-4.

A description is given of the development of the power economy of Bulgaria after World War 2. Brown coal is the most important native primary energy source. Water power will be developed to 50% of its potential at the end of 1975 and to 75% in ten years. The future power economy of Bulgaria depends to a great degree on the importing of energy carriers and the construction of nuclear power stations. Bulgaria will be the first Balkan country to use nuclear energy. The two PWR's of Kozloduy will provide 880 MW(e) after their start-up. (GE)

24051 NUCLEAR ENERGY BELONGS TO THE FUTURE. Mandel, H. Atom-Inf.; No. 12, 4-9(1974). (In German).

Following a report on the present state of construction of nuclear power plants in the Federal Republic of Germany, a prediction is made on the development up to 1985 and on the necessity of (a) standardization of nuclear power plants, (b) the construction of an infrastructure for the fuel cycle, (c) reprocessing capabilities, (d) the prefabrication and series fabrication of set scheduled power plant components, (e) clarity in the atomic energy licensing procedures, (f) an aimed publication. The promoting of further development of fast breeders is recommended, and the necessity for research and development in the field of HTGRs and their use in non-electric regions is pointed out. The importance of the reform of nuclear liability insurance is pointed out. (GE)

Reactor Fuel Cycle Economics

24052 (CONF-750317-) FUEL CYCLE CONFERENCE '75, Atlanta, Georgia, 18–21 March 1975. Summary Report. Gordon, E. (ed.). (Atomic Industrial Forum, Inc., New York (USA)). Jun 1975. 139p. Atomic Industrial Forum, Inc., New York.

Summaries of twenty-three papers are presented which deal with the following aspects of the nuclear fuel cycle: (1) reprocessing, (2) plutonium recycle, (3) economics, (4) uranium resources, and (5) enrichment. (DG)

24053 NUCLEAR FUEL CYCLE. Larson, H. J. (Atomic Energy Commission, Washington, DC). pp vp of Plutonium, Safeguards, and the Breeder. New York; Atomic Industrial Forum, Inc. (1975).

From AIF public affairs workshop on plutonium, safeguards, and the breeder; Knoxville, Tennessee, USA (8 Oct 1974). See CONF-7410119-.

An overview of the fuel cycle as it exists and is projected in the U. S. is presented. The economics and necessary facilities for fuel reprocessing, plutonium recycle, waste management, and spent fuel shipment are discussed. (HDR)

24054 FUEL FOR THE FUTURE. II. Nuclear Power From Thermal Reactors. Diamant, R. M. E. Heating and Ventilating Engineer; 49: No. 574, 22-26(May 1975).

The subject is treated under the following headings: introductory summary of fission and fusion; nuclear fission reactions and energy reserves; how a nuclear reactor works; technical basis; types of nuclear reactors; and comparisons between different types. (UK)

Reactor Licensing and Regulation

Refer also to abstract 23919.

24055 (CONF-7310110-, pp 15-21) IMPOSING GOVERNMENTAL SUPERVISION TO ASSURE SAFETY OF NUCLEAR PLANTS. Klik, F. 1974. (In Czech).

From conference on nuclear power plants and containment; Brno, Czechoslovakia (3 Oct 1973).

In conference on nuclear power plants and containment.

The criteria imposed in the siting of nuclear power plants in thickly populated areas are reviewed. The regulations assuring adequate containment and control of the release of radioactive emissions are summarized. The maximum permissible limits for radioactive gases and liquids are tabulated and compared with the actual emissions from European and American power plants. (JSR)

24056 (DOCKET-50255-543) PALISADES NUCLEAR PLANT. Semiannual Operating Report, January–June 1975. (Consumers Power Co., Jackson, Mich. (USA)). 29 Aug 1975. 332p. Dep. NTIS $19.75.

The first half of this period was a continuation of Outage 74-4. Retubing of the main condenser was completed and additional Eddy Current Testing in the steam generators was accomplished. On April 2, 1975 the unit returned to service to conduct the Steam Generator Flushing Program. From April 2 through June 20, 1975 the plant operated at power levels up to 90 percent, with two brief outage interruptions. On April 6, the turbine was tripped because of a leak in the flow instrument tap in the drain line from a feedwater heater to the moisture separator drain tank and on April 22, the turbine tripped due to low oil pressure in the electrohydraulic control system caused by a cracked fitting in the piping to a governor valve. In both instances, the plant was returned to service in a matter of a few hours. The plant was removed from service from June 20 until June 30, 1975 for control rod drive seal repair. The plant resumed operation on June 30, 1975. After a few hours' operation, an erratic feedwater control system tripped the unit from service; however, the unit returned to service the same day. An all volatile treatment program for secondary water has achieved reasonable water chemistry stability and continuous blowdown has removed small quantities of phosphate from the steam generators. Operation continued with two low pressure feedwater heaters and drain cooler bypassed in each train, pending retubing of the feedwater heaters. Two rows of blading of a low pressure turbine were replaced. (FS)

24057 (FIND-50524) FIND: ALAN R. BARTON NUCLEAR PLANT, UNITS 1, 2, 3, AND 4. Hendricks, P. L. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 37p. (FIND-50527). Dep. NTIS $4.00.

An index is presented for microfiche items 1 through 37 received by U. S. ERDA-TIC through April 24, 1975, for Docket 50524/50527. This material has been submitted by Alabama Power Company in conjunction with its application for construction permit and operating license for the Alan R. Barton Nuclear Plant, Units 1, 2, 3, and 4. Topics covered are in the license, technical, and environmental categories. Citations refer to items and grid coordinates and are given for major headings or topics of primary interest. (auth)

24058 (NUREG-75/070) LIMITED EARLY SITE REVIEW FOR THE VIDAL NUCLEAR GENERATING STATION. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Nuclear Reactor Regulation). Jul 1975. 36p. NTIS $3.75.

A preliminary evaluation of the suitability of a site near Vidal, California, for the construction of an HTGR nuclear power plant is presented. (JWR)

24059 (RDT-STATUS-7-75) BIMONTHLY STATUS REPORT OF RDT STANDARDS. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 31 Jul 1975. 56p. RSO.

24060 (REG/G-1.83(Rev.1)(7-75)) INSERVICE INSPECTION OF PRESSURIZED WATER REACTOR STEAM GENERATOR TUBES. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Jul 1975. 5p. NRC.

24061 (REG/G-10.1(Rev. 1)(7-75)) COMPILATION OF REPORTING REQUIREMENTS FOR PERSONS SUBJECT TO NRC REGULATIONS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Jul 1975. 12p. NRC.

24062 (WCAP-8110(supp. 9-A)) ICE FALLOUT FROM SEISMIC TESTING OF FUSED ICE BASKET. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Environmental Systems Dept.). May 1974. 12p. Westinghouse Electric Corp., Pittsburgh.

The Westinghouse Electric Corporation has performed a series of tests to demonstrate that the flake ice loaded into the ice condenser baskets will achieve sufficient fusion of the ice particles to withstand the design basis earthquake loadings at individual plant sites without loss of sufficient ice to impair the heat removal capability afforded by the ice condenser design. The report describes the tests performed, results of the tests and concludes that sufficient ice particle fusion is achieved after a minimum of five weeks storage to assure adequate ice retention for the design basis earthquake for all the land-based plant sites tested. (auth)

24063 ARE WE ASKING TOO MUCH IN QUALIFYING TESTS OF ELECTRIC MOTORS FOR NUCLEAR POWER STATIONS. Sheets, M. W. Power (N. Y.).; 119: No. 1, 48-49(Jan 1975).

The requirements, procedures, and costs of qualifying motors for nuclear Class I applications inside the containment are reviewed. (HDR)

24064 TECHNICAL GUIDE NO. 1. Com. Naz. Energ. Nucl., Not.; 21: No. 3, 109-120(Mar 1975). (In Italian).

A list is presented of the information required for the preliminary safety and protection analysis to be carried out as part of the investigation leading to the approval of the construction of proven-type nuclear power plants. (auth)

24065 PRESENT STATE OF THE URANIUM INDUSTRY AND POLICY IN CANADA. Com. Naz. Energ. Nucl., Not.; 21: No. 4, 66-70(Apr 1975). (In Italian).

A review is presented of Canada's uranium policy, particularly as regards reserves and exports. (auth)

24066 IEEE STANDARD SUPPLEMENTARY REQUIREMENTS FOR THE CALIBRATION AND CONTROL OF MEASURING AND TEST EQUIPMENT USED IN THE CONSTRUCTION AND MAINTENANCE OF NUCLEAR POWER GENERATING STATIONS. IEEE Std 498-1975. New York; Inst. of Electrical and Electronics Engineers, Inc. (1975). 12p.

This standard sets forth the requirements for a calibration program to control and verify the accuracy of M and TE (measuring and test equipment) which is used to assure that important

parts of nuclear power generating stations are in conformance with prescribed technical requirements, and that data provided by testing, inspection, or maintenance are valid. These important parts include those structures, systems, and components whose satisfactory performance is required; for the plant to operate safely, to prevent accidents that could cause undue risk to the health and safety of the public, or to mitigate the consequences of such accidents if they were to occur. (auth)

24067 IEEE STANDARD CRITERIA FOR THE PERIODIC TESTING OF NUCLEAR POWER GENERATING STATION CLASS 1E POWER AND PROTECTION SYSTEMS. IEEE Std 338-1975. New York; Inst. of Electrical and Electronics Engineers, Inc. (3 Jul 1975). 15p.

This document provides design and operational criteria for the performance of periodic testing of nuclear power generating station Class 1E power and protection systems. The scope of testing covered consists of functional tests, checks, calibration verification, and time response measurements. Criteria are also provided for determining system operational availability, status, and necessary documentation; and for establishing test intervals, shutdown test procedures during operation. Routine preventative maintenance is not covered by this document. (auth)

24068 RICHTLINIE FUER DEN FACHKUNDENACHWEIS VON KERNKRAFTWERKSPERSONAL. Verabschiedet im Laenderausschuss fuer Atomenergie, 8. Oktober 1974. (Regulation for the Professional Certification of Nuclear Power Plant Personnel. Passed in the State Board for Atomic Energy, October 8, 1974). Cologne; Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V. (Oct 1974). 11p. (In German).

Also published in Umwelt (Inf. Bundesminist. Innern) (Dec 1974) no. 37 p. 18-23.

The regulatory standard listed as UA II 4-513 805/2 in the Federal Ministry of the Interior serves as a basis for the licensing or supervising authority's professional certification of the nuclear power plant personnel which has to be submitted by the applicant in accordance with legal requirements and applies only to the certification of proficiency in fields directly related to the envisaged task. Certification of proficiency is required for all listed personnel who will start to work after January 1st, 1975. (GE)

24069 LICENSING OF NUCLEAR POWER PLANTS IN AUSTRIA. Staudinger, F. (Gemeinschaftskernkraftwerk Tullnerfeld G.m.b.H., Vienna (Austria)). Atomwirtsch., Atomtech.; 20: No. 5, 241-244(May 1975). (In German).

In Austria nuclear power plants, besides the necessary licenses, need official approval of compliance with radiation protection laws. Requirements are the coordination of the building procedures with those concerned with radiation protection, the legitimate claim on the granting of a license if radiation protection measures are adequate, and the mandatory hearing of expert opinion on claims that requirements for the granting of a license are fulfilled. (GE)

GENERAL AND MISCELLANEOUS

Civilian Defense

24070 (ORNL-5022) BEST SHELTER FOR CRITICAL INDUSTRY WORKERS. Cristy, G. A. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 89p. Dep. NTIS $5.45.

This report gives the results of a case study made by ORNL of the Knoxville-Knox County industrial area to determine the best methods for sheltering workers in critical industries which would continue to operate during a nuclear confrontation which had escalated to an urban evacuation. (auth)

24071 (ORNL-tr-2845) CIVIL DEFENSE. Titov, M. N.; Egorov, P. T.; Gayko, B. A. 1974. Translation of Grazhdanskaya Oborona. 129p. Dep. NTIS $5.45.

The Soviet Union has the most comprehensive and detailed evacuation-dispersal plan in the world. A description of this plan is given in the handbook, together with Soviet plans to protect industries and perform rescue-repair work. The book is a valuable resource to all interested in the U. S. civil defense program. The handbook should also be of interest to active defense planners and researchers, because not only does the present Soviet CD program reflect the Soviet theories on the nature of possible future threats to them, but also reveals, by implication, the kinds of threats that they themselves could present in the event of an escalating crisis. (auth)

Information Handling

24072 (ORNL-TM-4858) UNION LIST OF SERIALS IN THE TECHNICAL LIBRARIES OF THE OAK RIDGE–KNOXVILLE AREA. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 800p. Dep. NTIS $13.60.

Compiled by Southern Appalachian Chapter, Special Libraries Association.

The publication comprises all of Oak Ridge National Laboratory Libraries holdings as of September, 1974, but the list of holdings of the Oak Ridge Gaseous Diffusion Plant Library, the Oak Ridge Associated Universities Library, The Tennessee Valley Authority Libraries, and the University of Tennessee Libraries are incomplete. The Knoxville Academy of Medicine Library is no longer in existence, but its holdings have not been deleted from this edition. Entries, in most cases, follow the Library of Congress, New Serial Titles, rules. Directions for use of the list are shown. A key to locations and a key to abbreviations and symbols are given. (MCW)

24073 (STI/PUB-379) INFORMATION SYSTEMS: THEIR INTERCONNECTION AND COMPATIBILITY. Proceedings Series. Proceedings of a Symposium Held in Varna, Bulgaria, 30 September–3 October 1974. (International Atomic Energy Agency, Vienna (Austria)). 1975. 470p. (In Several Languages). (CONF-740927-). IAEA $28.00.

Forty papers are grouped into five sessions: state of development of international information systems and their interconnection; national, international, and intergovernmental discipline- and mission-oriented information systems and their compatibility; harmonization of national policies to improve interconnection and compatibility; compatibility of national and international standards and their use; and future-oriented ways and means for improving systems interconnection. Separate abstracts were prepared for 40 papers. (DLC)

For abstracts of individual papers see: 24075–24114.

24074 NON-PROLIFERATION TREATY EFFECT ON ENHANCEMENT OF IAEA ROLE IN INTERNATIONAL COOPERATION. Chapter 6. Kuvshinnikov, B. A. pp 141-167 of Atom and Peace. Non-Proliferation Treaty and International Atomic Energy Agency. Morokhov, I. D. (ed.). Moscow; Mezhdunarodnye Otnosheniya (1974). (In Russian)

The activity of the IAEA as an important organization in promoting cooperation in the area of world-wide use of nuclear energy is examined. Its structure is reported. Some basic trends of the scientific and technical activity of the IAEA are discussed. Special attention is given to the first international system for the dissemination of nuclear data—INIS, created within the framework of the IAEA. (tr-INIS)

24075 UNISIST PROGRAMME: ITS ROLE IN INTERNATIONAL COOPERATION IN SCIENTIFIC AND TECHNICAL INFORMATION. Wysocki, A. (UNESCO, Paris). pp 3-13 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The paper describes the UNISIST activities of a conceptual, normative, and operational nature directed towards the creation of an internationally acceptable framework for cooperation in the field of scientific and technical information. These activities are grouped into four sections: (1) development of national, regional, and international information policies; (2) improvement of the institutional and normative components of information transfer; (3) development of specialized information manpower; (4) assistance to member states in the inception and development of their information infrastructure. (auth)

24076 PLANNING AND DEVELOPMENT OF INIS: ITS APPLICATION OF UNISIST PRINCIPLES AND ITS INTERCONNECTION WITH OTHER INTERNATIONAL AND NATIONAL SYSTEMS. Turkov, Zh.; Chepkasov, A. (International Atomic Energy Agency, Vienna). pp 15-34 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The development of the International Nuclear Information System, the first fully decentralized, computer-based information system with a world-wide coverage of nuclear literature, is discussed. It is shown that INIS is the first example of a system achieving compatibility and cooperation of national information systems in nuclear science and technology. The main factors and prerequisites for such a cooperation are analyzed. The specific tasks in the planning of INIS are described as well as the basis to establish links between the national systems. (auth)

24077 AGRIS: PROBLEMS OF COMPATIBILITY AND INTERCONNECTION. Aubrac, R. (Food and Agriculture Organization of the United Nations, Rome). pp 35-40 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In French)

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The rules of compatibility and interconnection are indispensable elements of any information system based on the principle of international cooperation. The AGRIS system of information on agricultural sciences and techniques, organized on the initiative and under the sponsorship of FAO, provides an example of the problems of compatibility and interconnection arising both externally and internally. Externally, there is the problem that a sectorial system must be in contact with systems relating to other sectors so as to provide the users with access to multidiscipline information. Internally, the problem is one of maintaining contact between the decentralized input points and the processing centre (AGRIS level I), between the various subsystems and between the various components of these subsystems (AGRIS level II). To resolve these problems AGRIS employs the rules prepared by UNISIST and organizes the central processing (level I) jointly with INIS. The same rules will be a means of ensuring compatibility between AGRIS and the national documentation centres and associated systems like CARIS (system of information on agronomic research). The establishment of a worldwide network of libraries specialized in agriculture (AGLINET) will make it possible, by means of exchanges between existing or future libraries, to meet the increased demand for information that will result from the operation of such systems. (auth)

24078 BUILDING ON WHAT EXISTS: THE DEVELOPMENT OF AGRIS AS AN EXAMPLE OF SYSTEMS INTERCONNECTION. East, H.; Martinelli, M. T. (Food and Agriculture Organization of the United Nations, Rome). pp 41-50 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

In the development of the AGRIS Level One System problems have been encountered in attempting to use available information tools. The paper presents an analysis of the status of international standardization, relevant to the AGRIS system on the eve of its launching as an operational service. Several of the existing tools do not present a realistic approach to those developing a cooperative information system, neither are they helped by the tidal wave of new rules, standards and coordinating bodies. Internation-

ally developed information systems have the opportunity and the responsibility to interpret and adopt these standards. By doing so, they create the possibility of achieving actual coordination of information activities (at national and multinational levels) without having the imposition of standards as their main function. (auth)

24079 INTERNATIONAL INFORMATION SYSTEMS: THEIR RELATION TO ECONOMIC AND SOCIAL DEVELOPMENT. Woolston, J. E. (International Development Research Centre, Ottawa). pp 51-60 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Some developing countries have become active participants in INIS and have acquired resources that will help them exploit similar systems in other subject fields. Agriculture is important for all developing countries, and their spokesmen have stressed the value of having AGRIS Level One as the single and comprehensive source of bibliographic information. IDRC is attempting to facilitate the participation of developing regions in AGRIS Level One; its programs will support regional input/output operations in Latin America and Southeast Asia and permit central conversion of input from worksheets or paper tape to AGRIS magnetic tape. Several new specialized information-analysis centers, now being established in developing countries, look forward to their integration in AGRIS Level Two. The system harmonization promoted by UNISIST is of extreme importance to developing countries if they are to achieve maximum benefits from minimum resources. Within the UNISIST framework, there is an attempt to extrapolate the INIS-AGRIS experience into the social sciences, and to build a Development Sciences Information System (DEVSIS). This would cover the economic and social aspects of development, while leaving the sectoral information (agriculture, public health, education, mineral resources, etc.) for specialized systems in these sectors. The DEVSIS proposal was welcomed at an international meeting in Ottawa in June 1974. IDRC, OECD, Unesco and UNDP are now appointing a DEVSIS Steering Committee and Study Team, with the object of completing a design description in 1975. Following the recommendations of the Ottawa meeting DEVSIS will be designed to be responsive to governments, to follow UNISIST principles, and to be based in a UN organization. (auth)

24080 PROBLEMS OF AUTOMATIC INFORMATION RETRIEVAL AT THE AUSTRIAN RESEARCH CENTRE SEIBERSDORF. Nevyjel, A. (Oesterreichische Studiengesellschaft fuer Atomenergie GmbH, Seibersdorf). pp 61-69 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Information dissemination by computers is explained with respect to the problems that occur from using small computers. The program system of batch-processing procedures with the "direct file" organization developed by the Austrian Research Center Seibersdorf for evaluation of bibliographic data on magnetic tape is described. Some statistics about the evolution of the Austrian information service, user customs, and data base are given. Ideas for a special record format for accelerating the search process are explained. (auth)

24081 INIS: AN IMPORTANT TOOL FOR ESTABLISHING A NATIONAL INFORMATION SYSTEM FOR NUCLEAR SCIENCE AND TECHNOLOGY. Hybner, J. (Nuclear Information Centre, Prague). pp 71-76 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian)

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

In Czechoslovakia, INIS has been used as one of the basic tools for establishing an information system in the field of nuclear science and technology. At the Czechoslovak Nuclear Information Center, (the national center for liaison with INIS), codes have been written for the INIS-SDI system, which has been in use since 1 January 1974. At present 217 profiles are being processed, a number expected to reach 400 by 1980, by which time all the main aspects of the Czechoslovak nuclear program will be covered. The average relevance in the first half of 1974 amounted to 71.2%, the fraction of returned relevance cards being 76.4%. The users of computer search services receive, on request, both abstracts and full texts of published material, payment being required in all cases. The INIS-SDI system saves labor and reduces overall costs as compared with conventional information retrieval. Moreover, it contributes to the coordination of information work within the Czechoslovak nuclear program, which impinges on various areas of the national economy. IAEA should concern itself not only with the development of INIS but also with the general problems of nuclear information wherever it can play an important coordinating role. (auth)

24082 EXPERIENCE IN THE UTILIZATION OF INIS OUTPUT AND THE INTEGRATION OF INIS INTO THE SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM OF THE GERMAN DEMOCRATIC REPUBLIC. Schmidt, E. (Zentralinstitut fuer Information und Dokumentation der DDR, Berlin); Breitfeld, B. pp 77-81 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

In the German Democratic Republic (GDR) information media in the field of nuclear research and technology—as part of the State system of scientific and technical information—have access to many data bases and to a variety of information services. Their possibilities are being extended thanks to the services and output of INIS, and the needs of users are being met in a greater number of ways. A procedure whereby all INIS output is transmitted to other organizations by the GDR Central Institute for Information and Documentation (Zentralinstitut für Information und Dokumentation der DDR) has proved successful in practice, the Institute having a positive influence on the utilization of the output thanks to its collaboration with the information media concerned with nuclear technology. Scientists and technologists particularly appreciate receiving with only a short delay material in the form of extracts from ATOMINDEX arranged by subject categories within the subject scope of INIS and also the rapid delivery of the corresponding nonconventional literature on microfiche. Thus, the procedure followed in the GDR ensures the widespread use of INIS output in different parts of the economy. The Institute channels INIS output to users by means of computers through the selective dissemination of information and an "inquiry-answer" search for all users interested in computer retrieval from the INIS data base. At present, it is investigating (in collaboration with various information media) technical, economic, and other aspects of processing INIS magnetic tapes centrally and of access to the data base and also testing inquiry-search models. (auth)

24083 INIS IN NORWAY AND NORDIC REGIONAL COOPERATION. Wood, J. I. (Institutt for Atomenergi, Kjeller, Norway). pp 83-92 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Norway has participated in INIS since its inception, believing that INIS's decentralised, cooperative concept is particularly suited for small countries. Since nuclear power is not planned to play a part in the Norwegian power system before about another ten years, the effort expended has been limited and no direct use is yet made of magnetic tape output. Input is now at the rate of 200-300 documents/year. Nordic cooperation in the field of nuclear documentation is implemented through Nordic Atomic Libraries Joint Secretariat (NALJS) and INIS input from Denmark, Norway and Sweden is sent on a common magnetic tape. NORDFORSK, the Nordic body for cooperation in applied science, will in 1975 establish a Nordic I & D Network which will make all the documentation data bases in use in the Nordic countries available to all users on-line. The system is planned to include NSA and INIS and will possibly be connected to ESRO-RECON, and is of great potential interest to the Norwegian Institutt for Atomenergi. (auth)

24084 DEVELOPMENT OF AN INTERNATIONAL SYSTEM FOR THE EXCHANGE OF INFORMATION ON SCIENTIFIC AND TECHNOLOGICAL POLICY: SPINES. de Padirac, B. (UNESCO, Paris). pp 93-99 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In French).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

UNESCO has embarked upon a project aimed at establishing an international system for the exchange of information on scientific and technological policy: the "SPINES" system. The project entails: (a) the preparation of a UNESCO thesaurus relating to scientific and technological policy; (b) the preparation of some 3000 analytical abstracts of documents resulting from experi-

mental indexing carried out in order to test the thesaurus; (c) the drawing-up of a provisional world-wide inventory of periodicals devoted to scientific and technological policy; and (d) the conduct—within the conceptual framework of UNISIST—of a feasibility study covering the administrative, technical, legal and economic aspects of the development of SPINES. As regards (i) the general design of the system, (ii) the building-up of a thesaurus which will permit coordinated indexing, (iii) the rules for cataloguing, indexing and the preparation of analytical abstracts, and (iv) the standards for treating the information as it enters and leaves the system, the recommendations of UNISIST, the experience of INIS and the various international standards in existence have been and will be followed in the development of the system. The results of the feasibility study were examined and discussed in October 1974 at the 18th session of UNESCO's General Conference. (auth)

24085 COMPATIBILITY OF INIS WITH THE SOVIET UNION'S NATIONAL AUTOMATED SYSTEM OF INFORMATION ON NUCLEAR SCIENCE AND TECHNOLOGY. Semenov, V. F.; Kalinin, V. F.; Kiptenko, V. A.; Tyurnin, V. N. (Atominform, Moscow). pp 113-118 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The paper considers the compatibility of INIS with the Soviet Union's national system of information on nuclear science and technology from the point of view of providing nuclear specialists with documentation through harmonization of the standards of INIS and the Soviet national system and through the use of a single bilingual thesaurus and of literature-search algorithms. (auth)

24086 WILL THERE ALWAYS BE GREAT DIVERSITY AMONG THE WORLD'S SCIENTIFIC AND TECHNOLOGICAL INFORMATION HANDLING SYSTEMS. Baker, D. B.; O'Dette, R. E. (Ohio State Univ., Columbus). pp 119-129 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Today, science is one of man's best hopes for future social progress. It moves in the direction of unity, toward international understanding and cooperation in a world that, daily, becomes smaller and eventually must become a world community. This is also true for the world's science information handling systems, but these systems have been created for different purposes, developed on different schedules, are funded from various sources, and are responsible to many different kinds of institutions—governmental and private, commercial and non-commercial, national, and international. Recent recommendations of national and international bodies regarding scientific and technological discipline and mission-oriented information systems are critically analyzed in this paper. A broad outline of the problems of compatibility is presented including their technical, economic, policy and political aspects, especially in relation to more recently developed mechanized information systems and networks. Different levels of compatibility are identified and discussed. Real-life, practical examples of on-going activities to bridge the interfaces between discipline and mission-oriented information systems and services are examined in some detail. Conclusions and recommendations are offered as steps to help overcome the great diversities and to help lead toward better coordination and more effective interchange of scientific and technical information. (auth)

24087 EXAMPLES OF DISCIPLINE/MISSION COMPATIBILITY AND THEIR PROBLEMS. Barlow, D. H. (INSPEC, Institution of Electrical Engineers, London). pp 131-144 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The paper describes in four examples various cooperative interconnection arrangements that have been set up by INSPEC, in the fields of physics and electrotechnology. One example gives details of the successful interlinking between a centralized production system and the decentralized INIS operation, while in the second some of the pitfalls that have to be overcome in creating compatibility between organizations producing similar services are detailed. The remaining case histories deal with interconnection arrangements between data bases in differing languages and how ICSU-AB is attempting to help interconnection between abstracting and indexing services by providing an internationally agreed classification in physics as a bridge between French, German, American, and British organizations. (auth)

24088 NUCLEAR ENERGY AGENCY COMPUTER PROGRAM ACTIVITIES. Garcia de Viedma, L. (EURATOM, Ispra, Italy). pp 145-148 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

In 1964 the Nuclear Energy Agency of the OECD established the Computer Program Library located at the Joint Nuclear Research Center, EURATOM, Ispra, Italy. The paper describes the functions and aims of the Library and gives an indication of its future involvement in the field of Information Retrieval Activities. (auth)

24089 SOME PROBLEMS OF COMPATIBILITY AND COMMUNICATION IN THE NATIONAL SYSTEM OF SCIENTIFIC AND TECHNICAL INFORMATION OF THE PEOPLE'S REPUBLIC OF BULGARIA. Simeonov, S. V.; Andrianova, R. G. (Central Inst. for Scientific and Technical Information, Sofia). pp 159-166 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian)

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

In 1962 a start was made on the creation of a nationwide network of scientific and technical information media between which functional links have been established and downward and upward information flows defined. The organizational structure of Bulgaria's National System of Scientific and Technical Information comprises information media operating at three levels: the national, the departmental, and the local level. Links have been established between the individual media and work on the creation of data bases has been co-ordinated. To achieve greater efficiency in the information field, the Government in 1973 set itself the task of creating a national automated system of scientific and technical information. This consists of three types of subsystem: departmental, specialized, and library-bibliographic. Work is in progress to achieve compatibility between subsystems as regards information search languages, the mathematical foundations, and the technical basis. The national automated system of scientific and technical information will make extensive use of the possibility of establishing links with international and national systems of scientific and technical information. These links will be strengthened with regard both to information exchange and to the study of the latest advances in the information field. The development of links between the Bulgarian system of scientific and technical information and the information systems of other countries and of international organizations will contribute to a more rapid development of Bulgaria's system. (auth)

24090 CREATION OF A BILINGUAL THESAURUS FOR INDEXING DOCUMENTS AND INQUIRIES IN THE FIELD OF NUCLEAR SCIENCE AND TECHNOLOGY. Semenov, V. F.; Vasil'eva, N. V.; Bykova, L. N.; Kiptenko, V. A.; Strel'tsova, T. V. (Atominform, Moscow). pp 167-174 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The authors describe the problems of compiling a bilingual thesaurus relating to nuclear science and technology for a national data retrieval system. To facilitate the automated distribution of information received from INIS in response to requests of subscribers to the national system, the thesauri of the two systems were coordinated. The authors also touch on various problems relating to the compilation of a bilingual thesaurus and connected with the translation of terms used in two different terminological systems (a Russian and an English one). The translation of terms, revision, and maintenance of the thesaurus are based on a breakdown of descriptors within subject areas. The authors emphasize the difficulties of using a thesaurus of the type employed in INIS for data retrieval in response to inquiries. (auth)

24091 INPUT PREPARATION FOR INIS IN THE SOVIET UNION. Semenov, V. F.; Tyurnin, V. N. (Atominform, Moscow). pp 175-180 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The authors describe the organizational arrangements for INIS input preparation in the Soviet Union and the functions of and relations between the establishments involved. A detailed account is given of the work of the Central Research Institute

for Information and Technical and Economic Studies on Nuclear Science and Technology as regards INIS input preparation and the management of centers providing input to INIS. (auth)

24092 CINDA NEUTRON DATA INDEX: AN ILLUSTRATION OF COMPLEMENTARITY BETWEEN MISSION-ORIENTED AND SPECIALIZED INFORMATION SYSTEMS. Tubbs, N. A. (OECD/NEA Neutron Data Compilation Centre, Gif-sur-Yvette, France). pp 181-188 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The system design and operation of the CINDA computer index to neutron data, and the links between CINDA and files of numerical neutron data, are presented as an illustration of the working of a specialized information system. The advantages procured by simple indexing conventions, file operations oriented towards the work being reported rather than the medium in which it is published, and a file small enough for easy retrospective searching, are contrasted with the difficulty in assuring full coverage of the literature. A comparison with production methods of the literature-oriented, wide subject scope indices such as INIS suggests that regular cross-checking of specialized files against corresponding subsets of appropriate global indices could be useful to both types of system. Furthermore, such systems are complementary in the service they offer to users, and it is suggested that users might be well and relatively cheaply served by maintaining copies of appropriate complementary computer files at decentralized retrieval points. (auth)

24093 AEC/RECON SYSTEM: A CASE STUDY. Hughes, T. E. (United States Atomic Energy Commission, Washington, DC); Brooks, A. A. pp 189-195 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The United States Atomic Energy Commission since its establishment in 1947 has operated a comprehensive technical information program in support of the varied research and development activities in its national laboratories and elsewhere. Because of the broad scope of the program and the relatively decentralized nature of the activities, problems of compatibility and standardization have been emphasized from the beginning. Having relied almost entirely on the printed Nuclear Science Abstracts for bibliographic coverage of the technical literature needed by the program for more than twenty years, the USAEC has now added an interactive computer retrieval network, called AEC/RECON, to its roster of services. AEC/RECON has stimulated a further emphasis on standardization and compatibility to take full advantage of opportunities offered by computerized systems to share resources with other programs. The technical facilities of the AEC/RECON system are outlined and the history of its installation is summarized. (auth)

24094 NEED-BASED MISSION-ORIENTED INFORMATION SYSTEMS: THEIR PURPOSE, DESIGN, ORGANIZATION AND OPERATION IN DEVELOPING COUNTRIES, WITH SPECIAL REFERENCE TO INDIA. Kamath, V. A.; Malwad, N. M. (Bhabha Atomic Research Centre, Bombay). pp 197-210 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Attempts to meet the information demands of the ever-increasing pace of research activities in multidisciplinary subjects like nuclear science and technology have led to the emergence of mission-oriented information systems such as NSA, and now INIS, as distinct from the discipline-oriented information systems like Chemical Abstracts Service. While the developing countries need both, mission-oriented information systems are essential for their rapid all-round progress. Among the developing countries India holds a unique position on account of her vast size, population, natural resources, scientific and technical manpower, and scientific, academic and research institutions. The paper outlines the present state of scientific literature generation, scientific and technical libraries, and documentation and information services in India; the principal mission-oriented information systems, including the Library and Information Services of BARC in the nuclear field, are described. A brief account of India's participation in INIS and the present utilization of its services is given and the plans for the utilization of INIS magnetic tape are mentioned. The objectives of the proposed National Information System for Science and Technology are detailed. A three-phase model to establish a need-based mission-oriented information system for India is outlined. (auth)

24095 SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM OF THE GERMAN DEMOCRATIC REPUBLIC AND ITS INTEGRATION INTO THE INTERNATIONAL SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM OF THE CMEA COUNTRIES. Kneitschel, F. R. (Zentralinstitut fuer Information und Dokumentation der DDR, Berlin). pp 211-215 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In Russian).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The paper describes briefly the social, economic, and political foundations of the German Democratic Republic's scientific and technical information system and current trends within the system. It goes on to describe the need for scientific information work, which has arisen as a result of the increase in the role of science in socialist society and in response to socialist economic integration and to discuss ideas, principles and basic postulates relating to those improvements in the national information system that are necessary if that need is to be met—in particular integration of the national system into the international scientific and technical information system of the CMEA countries. (auth)

24096 PROSPECTS FOR A CONTRIBUTION BY THE NUCLEAR ENERGY AGENCY OF OECD TO THE IAEA INTERNATIONAL NUCLEAR INFORMATION SYSTEM IN THE FIELD OF NUCLEAR LAW. Reyners, P. (OECD Nuclear Energy Agency, Paris). pp 217-228 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In French).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The advantages of using data-processing techniques for the handling and dissemination of information in the field of law needs no further demonstration, and an increasing number of national and international bodies are using such techniques for that purpose. On the other hand, there is no central body concerned with nuclear law, a relatively new field which is developing rapidly and where there is a high degree of international harmonization. Although the IAEA International Nuclear Information System (INIS) covers nuclear law, owing to its essentially scientific nature it has not yet been able to provide in this field all the services which it provides in others. For its part, the OECD Nuclear Energy Agency (NEA) has for several years been engaged in documentation and analytical work relating to nuclear legislation and publishes legal studies and a review entitled "Bulletin of Nuclear Law". The Secretariats of the two agencies felt that, to increase the dissemination by INIS of data on nuclear law, the system should receive the information collected for its own studies by the legal service of NEA within the OECD countries. Such a contribution by NEA to INIS would enable greater use to be made of the assembled material and would provide INIS with the means of informing the international legal community interested in nuclear law of the work which has been done in this field and of regulatory developments. (auth)

24097 FRENCH ASSOCIATION FOR NUCLEAR DOCUMENTATION AND INFORMATION AND ITS RELATIONS WITH INIS. Cheron, C. (Groupement pour les Activites Atomiques et Avancees, Le Plessis-Robinson, France); Vergnes, G.; Guilloux, R. pp 229-236 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In French).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The gradual building-up of a French scientific and technical information network has led to the establishment, for the nuclear sector, of a sub-network operated by the "French Association for Nuclear Documentation and Information" (AFDIN). The paper describes the organizational structure and the objectives of AFDIN, and goes on to show how AFDIN publicizes INIS and arranges for the input of French data into it, how INIS products and services are used in France, and how INIS is being improved. The authors point out in conclusion that, while AFDIN is intended to provide services complementary to those of INIS so that France's needs are met fully, it will be able to rely increasingly on INIS, which (it is to be hoped) will develop steadily. (auth)

24098 HARMONIZATION OF NATIONAL POLICIES TO IMPROVE INTERCONNECTION AND COMPATIBILITY. Baker, D. B. (Ohio State Univ., Columbus). pp 247-255 of Information Systems: Their Interconnection and Compatibility. Vienna;

International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Many nations have no current, publicly stated national policy for information systems. Other nations which have issued statements about their domestic systems have not generally stressed interconnections as a component of national policy. Development of sound national policy depends upon many management functions such as forecasting, planning, establishing goals and objectives, design, scheduling, budgeting, and refining and restating existing policies or establishing new policies for new circumstances. Interconnections and compatibility generally today refer to machine-readable data and machine-to-machine interfaces. We have not yet solved many of the simple, pre-computer problems of compatibility, much less the interconnections which imply reciprocal relationships. And, it is doubtful that any existing documentation or data processing standard is universally satisfactory. The world information transfer community needs the benefits that ideal systems interconnection and compatibility would bring. (auth)

24099 PRINCIPLES INVOLVED IN CREATING AN INTERNATIONAL SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM FOR THE MEMBER STATES OF THE COUNCIL OF MUTUAL ECONOMIC ASSISTANCE (CMEA). Sorokin, Yu. N. (International Centre for Scientific and Technical Information, Moscow). pp 257-264 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The basic principles involved in creating an international scientific and technical information system for CMEA countries and ways of solving problems of sub-system compatibility are considered. (auth)

24100 LEGAL ASPECTS OF THE HARMONIZATION OF NATIONAL POLICIES FOR THE IMPROVEMENT OF INTERCONNECTION AND COMPATIBILITY. van Dijk, M.; Breton, J. M. (Bureau Marcel van Dijk, Brussels). pp 265-285 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In French).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Law and science do not advance at the same pace. Legal protection, which was originally instituted for literary and artistic works, has therefore been extended to cover scientific and technical publications. A compromise has to be found between authors' and publishers' copyright and the free circulation of information. The authors review the state of existing and projected legislation relating to the protection of confidential personal data and to copyright. Exceptions to the right of reproduction are considered in order of increasing liberality, after which present procedures in photographic reproduction (reprography) are analysed from the standpoint of copyright. Lastly, the authors discuss the present trends in copyright law as applied to secondary productions and consider the general line taken in agreements and discussions in progress—both in terms of regulations and conventions and also on a legal plane—with regard to the standardization of exchange formats, the harmonization of documentary languages, the imposition of terms on users by producers of documentary material on magnetic tape and by those engaged in operations with them, the provision of original versions or photocopies of primary documents, and, finally, the protection of computer software. (auth)

24101 USAEC TECHNICAL INFORMATION CENTER DATA BASE EXPANSION TO INCLUDE NON-NUCLEAR ENERGY INFORMATION. Vaden, W. M.; Bost, D. E.; Kawakami, N. (Atomic Energy Commission, Oak Ridge, TN). pp 287-293 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The AEC's Technical Information Center (TIC) is making a major expansion of its computerized information data base through the addition of non-nuclear energy information. This information is being processed using the same standards as used for the 450,000 nuclear information items already machine searchable. Input processing involves the usual cataloguing and indexing procedures, including report acquisition and journal scanning, but, where available, information is also being obtained by means of machine searches of existing magnetic tape files obtained from outside sources. Both cataloguing and subject indexing are being converted to INIS standards before inclusion in the TIC data store. (auth)

24102 ACCEPTANCE OF INTERNATIONAL STANDARDS. Gray, J. C. (British Library Research and Development Dept., London). pp 301-305 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

With increasing international cooperation in the field of library science and documentation, international standards are of even greater importance than previously. A study has been commissioned to examine the way in which eight data-base producers have adopted various ISO standards and other international guidelines and this study is summarized with particular reference to the adoption of ISO 2709. A suggested methodology for the future development of acceptable international standards is outlined. (auth)

24103 APPLICATION OF STANDARDS IN SYSTEMS INTERCONNECTION. Middleton, R. W.; Eggert, J.; French, E. J. (International Organization for Standardization, Geneva). pp 307-333 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The first step towards successful application of standards is to recognize the need. Then standards must be developed and promoted. Information and advice must be available to the user. Cooperation with the user provides feedback, leading to an improved system of standards. Economic as well as technical reasons dictate the need for International Standards in systems interconnection. Many International Standards have been developed to aid information transfer but others are needed. ISO technical committees dealing with terminology, documentation and information processing have extensive programmes designed to meet this need. Some sources of information and guidance in the application of standards exist already and others are planned. They include catalogues and indexes, specialized centers, and the developing ISO Information Network. Ways are suggested for furthering the application of standards in systems interconnection including a special follow-up meeting of international organizations operating information systems. (auth)

24104 USE OF ISO STANDARDS IN INIS. Gove, N.; Schmid, H.; Chepkasov, A.; Turkov, Zh.; Gadjokov, V.; Todeschini, C.; Binggeli, M. H.; Schallaboeck, G.; Ruckenbauer, E.; Davis, D.; Del Bigio, G.; Holub, J. (International Atomic Energy Agency, Vienna). pp 335-347 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

INIS has made full use of international standards wherever possible. Examples include character codes, descriptive cataloguing rules, country codes, record formats, and thesaurus structure. Forthcoming international standards will be used where possible, e.g., for book and serial codes. There are some areas where standardization might be of value, for example, character code extensions, abstract formats, microfiche formats. Two large and difficult areas where some progress might be made are software interchange standards and thesaurus interchange standards. Since INIS is an operational, cooperative system, involving many national computerized information projects, it is particularly sensitive to standards. The use of good standards for information interchange is essential to the success of INIS. (auth)

24105 STANDARDIZATION IN INFORMATION SYSTEMS: SOME PROS AND CONS. Stokely, E. E. (Atomic Energy Commission, Washington, DC). pp 349-351 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

Standards are the foundation of information systems: viable information systems are not possible without them. They are also the basis for compatibility between systems. Properly drawn standards can result in savings, can improve the quality of information service, are very helpful to system users, and promote efficiency throughout a system. Even though they are costly to introduce, difficult to keep up to date, psychologically burdensome, and may discourage creativity, they are a necessary adjunct of any information system. (auth)

24106 INTERNATIONAL STANDARDIZATION AS THE MAIN PRECONDITION FOR THE DEVELOPMENT OF INTERNATIONAL

INFORMATION SYSTEMS WITH SPECIAL REGARD TO INIS AND SIMILAR COOPERATIVE SYSTEMS. Vajda, E.; Lazar, P.; Schiff, E. (Hungarian Central Technical Library and Documentation Center, Budapest). pp 353-364 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The establishment, operation, and interconnection of international information systems is becoming nowadays the essential precondition of providing information on international, national, and local scales. The operation and interconnection of these systems and the effective utilization of their services ask for the international standardization of information tools, techniques and media. The paper surveys the different types of normative instructions, the subject fields, and the levels of international standardization, evaluating their present state. Standards elaborated by ISO/TC 46 are first taken into consideration, but the results of the work of other international organizations are also referred to. The most important tasks concerning the planning and coordination, the harmonization of the different types and levels of activities, and the dissemination of the results of standardization are summarized. Special emphasis is laid upon a typical example, an international information system provided with a complete set of internal standards, namely INIS. Specific problems of developing countries are also mentioned. (auth)

24107 STANDARDIZATION AND COMPATIBILITY ISSUES IN THE UNISIST PROGRAMME. Loehner, W. (UNESCO, Paris). pp 365-370 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

To improve the international flow of information, UNISIST develops the necessary conditions to interconnect information systems and/or achieve a higher degree of compatibility. To this end, several actions have been initiated—particularly in the area of bibliographic descriptions, terminology, abstracting and indexing, and mechanical treatment—such as the UNISIST Reference Manual for machine-readable bibliographic descriptions, a comparative study of bibliographic systems and/or standards, the UNISIST Manual for Information, Handling Procedures, an International Information Center on Standards in Documentation and Information, guidelines for monolingual and multilingual thesauri, etc. (auth)

24108 PUBLISHING JOURNALS FOR USERS. Metzner, A. W. K.; Marks, R. H.; Koch, H. W. (American Inst. of Physics, New York). pp 371-381 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The principal users of primary research journals are the scientists who are also the producers of the information in the journals. They recognize that they are not the only users, and, especially in physics, take pains to aid the dissemination of information to other users, for example by creating consistently high-quality abstracts and subject classification terms. The function of the American Institute of Physics (AIP) is to perform publishing services for a number of professional societies in physics, astronomy, and physics-related areas. The size of AIP's publishing operation is such that it can and does make important contributions to maintaining standards of quality and format of physics information input to primary publications and to secondary services. In particular, the abstracts of articles published by AIP or its member societies are available in machine-readable form and in any desired printed format. AIP's use of new technology and its close contact with the physics community permits it to develop many new communications options. (auth)

24109 TRAINING AND INSTRUCTIONAL ACTIVITIES AS A MEANS OF IMPROVING SYSTEMS INTERCONNECTION. Wersig, G. (Freie Univ., Berlin). pp 393-400 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

International information systems face the situation that personnel with widely differing backgrounds have to collaborate. This diversity is based on: differently defined levels of education and training; different educational approaches and philosophies; and differently organized education and training. On the international level some general trends in education and training can be observed: the distinction between information workers and scientists; the development of new occupational roles; and the development of a common core for librarianship, archives, and information services. Some problems in the current discussion are: horizontal mobility; information science versus computer science; vocational versus theoretical training; professional training and continuous education; and professional training versus general education. Some constraints on the realization of appropriate solutions are: different vocational education systems; different national education policies; regional and international activities; governmental and non-governmental organizations; and subject-specific and general-oriented international organizations. The present state is characterized by the lack of data, internationally accepted definitions, communication, evaluation and co-ordination. Some Unesco activities are attempting to improve this situation. (auth)

24110 ESTABLISHMENT OF COMPATIBLE INFORMATION INFRASTRUCTURES, PARTICULARLY IN DEVELOPING COUNTRIES. Fassi-Fihri, A. (Centre National de Documentation, Rabat, Morocco). pp 401-407 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975). (In French).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The paper summarizes what has to be done in order to establish information infrastructures in developing countries. It also outlines the interconnection problems of a future worldwide documentation network dependent on compatibility of the proposed documentation systems. Lastly, it reviews what has been done in Morocco in this respect, indicating the problems and difficulties encountered—especially as regards documentation terminology and specialized personnel—and emphasizing the need to establish schools where personnel can be trained. (auth)

24111 FEASIBILITY STUDY OF AUTOMATIC INDEXING OF INIS ABSTRACTS. Perschke, S. (Commission of the European Communities, Ispra, Italy); Vernimb, C. pp 409-416 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The Information Science Research unit of CETIS is conducting, in cooperation with the Directorate General XIII of Luxembourg, a full study of the automatic indexing of INIS abstracts with the INIS Thesaurus. As INIS is planning to produce and distribute the abstracts in machine-readable form, automatic indexing will become extremely attractive from the economic viewpoint. The preparational work for this study (conversion of the thesaurus, definition of the indexing algorithm and parameters) is expected to be concluded by the end of 1974, while the assessment of the indexing efficiency with a possibly large data base is planned for 1975. The cooperation of contributing centers of INIS for obtaining machine-readable data and participating in the evaluation in a real-life situation would be extremely welcome. (auth)

24112 NETWORK FOR TECHNOLOGICAL INFORMATION TRANSFER IN DEVELOPING COUNTRIES. Knox, W. T. (National Technical Information Service, Washington, DC). pp 417-425 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

This paper describes the objectives and present status of an experimental program operated by the US National Technical Information Service (NTIS), and funded by the US Agency for International Development (USAID), to promote the awareness and utilization of the vast NTIS resources of technological information for the benefit of developing countries. The experimental program is now beginning its third year, and will continue for two years from the present. The initial approach was to produce an abstracts bulletin covering current reports in subject areas of special interest to developing countries, which comprised only 2% of the total NTIS collection. Usage of the bulletin proved to be lower than expected, so an alternate approach was devised: a network of locally based organizations in 10 developing countries was created to act as agents for NTIS products and services. A commercial incentive was offered by NTIS: a discount of 25% from the listed product price, in return for local promotion, order handling, and customer service. NTIS also offers extensive training and on-site assistance for the promo-

tional effort, with special attention to the country's infrastructure for technical information. (auth)

24113 WORLD INFORMATION SYSTEMS IN A DEVELOPING COUNTRY. Khan, M.N.G.A. (Bangladesh Atomic Energy Commission, Dacca). pp 427-432 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The advancement of science and technology has given rise to the proliferation of scientific literature, handling of which can best be done through the introduction of world information systems. Operation of these systems should provide reasonable flexibility to accommodate the specific needs and special situations in developing countries. The paper briefly reviews the state of science and scientific information in Bangladesh, as an example of a developing nation, in the context of world information systems and their necessity to a developing country like Bangladesh. (auth)

24114 TRAINING AND TEACHING ACTIVITIES PERFORMED BY THE ITALIAN INIS NATIONAL CENTRE: THEIR FAVOURABLE FUNCTION IN VIEW OF A CONNECTION WITH OTHER NATIONAL INFORMATION SYSTEMS. Ballarin, M. (CNEN, Rome); Stoppini, P. P.; Carosella, M. P. pp 433-449 of Information Systems: Their Interconnection and Compatibility. Vienna; International Atomic Energy Agency (1975).

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974). See STI/PUB-379; CONF-740927-.

The Italian situation in the field of scientific and technical documentation, with particular reference to personnel training, is reviewed. The efforts of INIS National Center to organize its structures in this framework are described. One of the first tasks was the organization of a training course for indexing specialists to prepare the Italian input. The results obtained in this activity are described and details of the course are given. The action of the INIS National Center in establishing contacts with Italian documentation institutions both in an attempt to link the activities of various developing information systems and for disseminating knowledge about INIS is outlined. Mention is made of Italian initiatives in the framework of international information systems. It is concluded that such activities should be coordinated by a suitable central body. It is hoped that a clear political intent will be shown for programming these efforts, which at present are based mainly on individual actions. (auth)

Law

Refer also to abstract 24096.

Management

24115 (EUR-5260e) JOINT RESEARCH CENTRE ANNUAL REPORT, 1973. (Commission of the European Communities, Ispra (Italy). Joint Research Center). Dec 1974. 454p. Dep. NTIS (US Sales Only) $25.75. EUR B. Fr. 550,-.

The report is a comprehensive review of the work carried out during 1973 in the Ispra establishment of the Joint Research Centre. The first part is devoted to a description of the activity carried out in the frame of the so-called "objectives" of the 1973 research program. In the second part are described, from the viewpoint of the Scientific Divisions of the Centre, some of the most relevant scientific and technical achievements. In the third part the operation of the big installations is reported. The fourth part treats both the technical and administrative support activities. A bibliography of reports, contributions to conferences, seminars and meetings etc. is given at the end. (auth)

24116 (INDC(SEC)-47/U) INDC CORRESPONDENTS FOR THE EXCHANGE OF NUCLEAR DATA INFORMATION. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Jun 1975. 49p. Dep. NTIS (US Sales Only) $5.50.

The list contained herein serves as a basis for the distribution of documents originated by or for the International Nuclear Data Committee, and includes the names of all recipients of INDC documents. (RWR)

24117 (IS-3700) 1974 ANNUAL SUMMARY REPORT. (Ames Lab., Iowa (USA)). Jul 1975. Contract W-7405-eng-82. 123p. Dep. NTIS $5.25.

This report consists of collections of abstracts of papers published during the previous calendar year in the areas of high-energy physics, nuclear science, materials science, and molecular science. This collection supplements the listing of papers published in the Schedule 189. Principal divisions of the report are as follows: high-energy physics, nuclear science, materials science, structure of materials, mechanical properties, physical properties, radiation effects, solid-state physics, neutron scattering, experimental physics (electron structure and magnetic properties of solids, nuclear resonance in solids, superconductivity, thermodynamic and transport properties of solids, optical and spectroscopic properties of solids, rare earth metals preparation), theoretical physics (optical and surface physics, superconductivity, magnetic and electrical properties), materials chemistry, chemical structure, engineering chemistry, high-temperature and surface chemistry, molecular sciences, radiation and separations research, radiation sciences, separations research, chemical and geophysical energy, chemical energy, molecular and atomic sciences, chemical physics, analysis (analytical spectroscopy, analytical separations, analytical mass spectroscopy, activation analysis and electro-analytical chemistry, lasers in analytical chemistry), mathematical and computer sciences, and mathematical sciences. (RWR)

Mathematics and Computers

Refer also to abstracts 22392, 23378, 23505, 23788, and 24117.

24118 (CONF-741001-, pp 255-261) NET-2 NETWORK ANALYSIS PROGRAM. Malmberg, A. F. (Los Alamos Scientific Lab., NM). 1974.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

In Cube symposium, Lawrence Livermore Laboratory, October 23–25, 1974. Symposium proceedings. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

The NET-2 Network Analysis Program is a general purpose digital computer program which solves the nonlinear time domain response and the linearized small signal frequency domain response of an arbitrary network of interconnected components. NET-2 is capable of handling a variety of components and has been applied to problems in several engineering fields, including electronic circuit design and analysis, missile flight simulation, control systems, heat flow, fluid flow, mechanical systems, structural dynamics, digital logic, communications network design, solid state device physics, fluidic systems, and nuclear vulnerability due to blast, thermal, gamma radiation, neutron damage, and EMP effects. Network components may be selected from a repertoire of built-in models or they may be constructed by the user through appropriate combinations of mathematical, empirical, and topological functions. Higher-level components may be defined by subnetworks composed of any combination of user-defined components and built-in models. The program provides a modeling capability to represent and intermix system components on many levels, e.g., from hole and electron spatial charge distributions in solid state devices through discrete and integrated electronic components to functional system blocks. NET-2 is capable of simultaneous computation in both the time and frequency domain, and has statistical and optimization capability. Network topology may be controlled as a function of the network solution. (auth)

24119 (HEDL-TME-75-45) HDES5: A SUBROUTINE TO SOLVE A SYSTEM OF DIFFERENTIAL EQUATIONS. Gneiting, B. C.; Bard, F. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2170. 28p. Dep. NTIS $4.00.

The subroutine HDES5 contains a numerical method for solving a system of first-order differential equations. Some features of the HDES5 subroutine are as follows: a fifth order predictor-corrector method is used; it performs very well in comparison with other differential equation system solver subroutines; it is easy to incorporate into large-scale computer programs; it has relatively low core storage requirements; the execution times are low for relatively smooth problems. (auth)

24120 (UCRL-51720) PSEUDO-GRAY-LEVEL IMAGES VIA TMDS AND RJET. Pressman, N. J.; Vickers, D. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Dec 1974. Contract W-7405-Eng-48. 16p. Dep. NTIS $4.00.

A specialized routine for display of pseudo-gray-level images was developed. The LLL Octopus-based system provides remote output of both hard and soft copy via Remote Job Entry Terminal Versatec printer plotters and the Television Monitor Display System. The chief advantages of this routine are rapid turnaround for low-spatial-resolution and low-gray-level-resolution images and the utilization of hardware readily available to users of the LLL central computer facilities (Octopus). (auth)

24121 (UCRL-51794) DETERMINING THE NATURAL FREQUENCIES OF SPHEROIDS VIA THE BOUNDARY-VALUE PROBLEM FORMULATION. Lytle, R. J.; Deadrick, F. J.

(California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Apr 1975. Contract W-7405-Eng-48. 21p. Dep. NTIS $4.25.

Equations by which one can determine the natural frequencies of prolate and oblate spheroids are derived by using the boundary-value-problem approach. Both transverse magnetic and transverse electric excitations are considered. Numerical results are given for the natural frequencies of transverse-magnetic-excited prolate spheroids with various eccentricities, demonstrating natural mode dependence on eccentricity. Numerical difficulties, however, precluded obtaining natural frequencies for oblate spheroids, transverse-electric-excited prolate spheroids, and transverse-magnetic-excited prolate spheroids with sheaths. (9 figures, 4 tables) (auth)

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